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ECONOMIC INTELLIGENCE REPORT

INDUSTRIAL CAPITAL INVESTMENT IN COMMUNIST CHINA: THE ELECTRIC POWER INDUSTRY 1953-57



CIA/RR 136

16 June 1958

CENTRAL INTELLIGENCE AGENCY

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ECONOMIC INTELLIGENCE REPORT

INDUSTRIAL CAPITAL INVESTMENT IN COMMUNIST CHINA:
THE ELECTRIC POWER INDUSTRY
1953-57

CIA/RR 136

(ORR Project 30.1535D)

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FOREWORD

This report is one of several on industrial investment in Communist China. Its purpose is threefold: to establish the magnitude of investment funds allocated to the electric power industry as compared with total national investment; to investigate the structure of investment in administrative, temporal, and geographic dimensions common to Chinese Communist industry as a whole; and to discuss some of the technical problems of the allocation of investment funds within the electric power industry which are unique to the industry.

The emphasis of this report is on the First Five Year Plan (1953-57). Enough information is given on the rehabilitation period (1949-52) and the Second Five Year Plan (1958-62) to place the First Five Year Plan in perspective.

At the time of the writing of this report, no official statistics on the electric power industry of Communist China were available. Practically all the figures presented in this report, therefore, are estimates. This report states that capital investment by the Ministry of the Electric Power Industry under the First Five Year Plan amounted to 2,900 million yuan and that the added capacity installed by the Ministry amounted to 1,910 megawatts. Information received since the completion of the report states that capital investment by the Ministry amounted to 2,979 million yuan and that the added capacity installed by the Ministry amounted to 2,164 megawatts. The essential conclusions of the report are not invalidated by the additional information.

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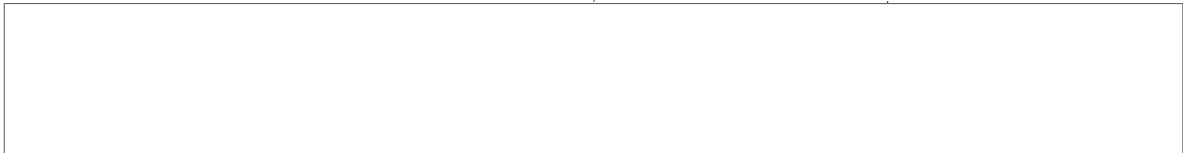
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INDUSTRIAL CAPITAL INVESTMENT IN COMMUNIST CHINA:
THE ELECTRIC POWER INDUSTRY*
1953-57

Summary

The First Five Year Plan (1953-57) of Communist China established two goals for the electric power industry -- the reconstruction of existing facilities, principally in the Northeast, and the establishment of new industrial bases for future expansion in the interior near sources of energy. To achieve these goals, 3,400 million yuan** were allocated for capital investment in the electric power industry. To obtain the maximum benefit from such investment, the Chinese Communists sought the more intensive utilization of operating power plants and constructed thermal power plants instead of the more expensive hydroelectric power plants.

Under the First Five Year Plan the value of fixed assets*** in the electric power industry of Communist China increased from approximately 2,320 million yuan at the end of 1952 to 5,110 million yuan at the end of 1957. As a result of this increase in capital investment, the installed capacity of the industry increased from about 2,030 megawatts (mw) at the end of 1952 to 4,222 mw at the end of 1957, and production increased from 7.3 billion kilowatt-hours (kwh) in 1952 to 18.9 billion kwh in 1957. Although the established industrial areas in the Northeast

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 May 1958. Recent information, which is cited in the Foreword, indicates that total capital investment during 1953-57 amounted to 3,500 million yuan, that the value of fixed assets in 1957 was about 5,200 million yuan, and that the capacity of the electric power industry at the end of 1957 was about 4,300 megawatts.

** This sum equals US \$1,400 million at the standard rate of exchange of 2.46 yuan to US \$1. To reproduce the Chinese Communist program of construction in the US might cost \$500 million. The difference probably can be explained partly by the fact that the Chinese are paying about 100 percent above world market prices for imported equipment and partly by the different structure of prices in China and the US.

*** The term value of fixed assets or fixed assets refers to the value of capital assets in operation or in use at a specific point in time, usually at the end of the year.

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received the largest share of new investment, the most rapid rate of increase was shown by areas in the interior near sources of energy.

Under the Second Five Year Plan (1958-62) the electric power industry of Communist China will continue to expand more rapidly than industry as a whole. Emphasis will be placed on the construction of hydroelectric power plants and, in the North, where most of the reserves of coal are located, on the construction of thermal power plants. The electric power industry will receive an increasing share of total capital investment and will, in turn, contribute an increasing portion of the gross national product. Production by heavy industry is expected to double during the 5-year period.

I. Introduction.

A. Definition of the Electric Power Industry.

For purposes of this report, the term electric power industry will include all generation of electric power and its transmission.* It will not include distribution* of electric power to ultimate consumers, a concept which is usually included in the industry in the US. This exception is made for two reasons. First, it is a Soviet practice, apparently followed by Communist China, to allocate to town governments the responsibility for distribution of electric power to the ultimate consumer in urban areas. In rural areas in China the land reclamation organizations have this responsibility.** Apparently, neither investment in distribution facilities nor sale of power is part of the responsibility of the electric power industry of Communist China. This allocation of responsibility is in line also with usual Soviet practice, in which consumer sales are not handled by the producing organization. Second, no information is available on investment in systems of distribution or on

* By transmission is meant the carrying of electric power from the generating plant along power lines (in China, usually 22 kilovolts or more) to a substation. By distribution is meant the parceling out of this power to the ultimate consumers along lines of lower voltage.

** For a fuller discussion and the implications for investment practice, see Appendix A.

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their growth during the period of Communist control. Any estimates would have to be made on the basis of the situation before the Communists gained control or from analogy with international practice.

The definition of the electric power industry as adopted in this report varies from the Chinese Communist definition for purposes of investment. When the Chinese speak of investment in the electric power industry, they mean investment by the Ministry of the Electric Power Industry, which comprises about 85 percent of the industry as defined in this report. In addition to power generated by the Ministry, power is produced by local (provincial or autonomous republic) governments, by various industrial ministries, and by joint public-private corporations.*

B. Scope of This Report.

This report traces the development of the electric power industry of Communist China, concentrating upon the period of the First Five Year Plan (1953-57). It includes estimates of the investment allocated to the industry, the additions to fixed assets accruing therefrom, and the resulting productive capacity added. It indicates some of the major problems of the allocation of investment funds within the industry and discusses some of the alternatives involved. In addition, it examines the expenditures for equipment and the degree to which the industry depends upon foreign sources for expansion. Finally, it portrays the regional pattern of investment against the background of present industrial development and of future availability of energy resources.

C. Importance of the Industry.

The aim of the First Five Year Plan for the development of the national economy of Communist China in the years 1953-57 was "to convert China ... from a backward, agricultural country into an advanced socialist state." 1/** To achieve this goal, priority was to be given to heavy industry, 2/ and the first specific task was to expand the electric power industry, 3/ for without an adequate base of electric power no modern industry can grow. The emphasis on developing electric power was intensified by the fact that most of the new industries built under the First Five Year Plan used the most modern Soviet techniques, which, in turn, rely upon a high degree of automation and electrification.

* Public-private corporations are organized by the Chinese Communists to socialize private business. The state channels government investment to an existing private business and thereafter manages the enterprise.

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II. Period of Rehabilitation* (1949-52).A. Growth of the Industry.

When the Communists assumed power in China in 1949, they inherited an electric power industry which was to a great degree obsolete and in disrepair, with fixed assets of about 2,180 million yuan. The total installed generating capacity was 1,850 mw,** and the total production in the country, due mainly to the disruption caused by the civil war, was only 4.3 billion kwh. 5/ In addition, an estimated capacity of 180 mw 6/ and a reported production of 595 million kwh 7/ were available to Manchuria from the Sup'ung hydroelectric power plant on the Yalu River in North Korea.

During the first 3 years of their rule the Chinese Communists undertook to rehabilitate the existing capacity rather than to add new capacity. Equipment with a generating capacity of 200 mw was repaired or restored between 1949 and 1952 at a cost of about 90 million yuan. 8/ In addition, about 50 million yuan were expended on the restoration of transmission facilities. An increase of 10 percent in generating capacity with an increase of only 6 percent in fixed assets became possible because the cost of repair and reconstruction was only 300 to 600 yuan per kilowatt. These figures were 20 to 40 percent of the cost of comparable facilities in a new plant. 9/ Net consumption*** increased 63 percent during these 3 years, reflecting the rehabilitation of the consuming industries. The fact that gross consumption increased only 49 percent results from a reduction of consumption and loss within the electric power industry, which is claimed to be 50 percent.****

* Rehabilitation consists of placing in operation a plant and its equipment which are already in place but which are in need of repair.

** See Table 1, Appendix B, p. 30, below. It should be noted that the total national capacity apparently includes only power plants with a capacity of 500 kilowatts and more, as was reported by Chen Chi-yuan at the Fifth World Power Conference held at Geneva, Switzerland, in June 1956. 4/

*** Net consumption is consumption by consumers other than the electric industry itself. Gross consumption includes losses and consumption within the electric power industry.

**** Such a great decrease in consumption and loss within the electric power industry probably resulted more from the application of improved accounting procedures than from technological amelioration.

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The Chinese were forced to increase production of electric power by 70 percent to meet the increased consumption because power imported from North Korea, amounting to 12 percent of the total gross consumption, had been cut off by the US bombing of the hydro-electric power plant at Sup'ung. The easiest way to increase production of power, if the pattern of the load permits, is to increase the plant factor* and obtain more production from the existing facilities. In this way the Chinese Communists largely met the need for more power. They increased the hours of utilization from an annual average of 2,300 in 1949 to 3,700 in 1952, an increase in the plant factor from 27 to 42 percent. 10/

B. Status of the Industry in 1952.

1. Total Fixed Assets.

At the end of 1952 the total installed capacity for generating electric power in Communist China is estimated to have been 2,030 mw. Of this total, it is estimated that about 1,560 mw,** or 77 percent, was administered by the Main Control Bureau for Electric Power of the Ministry of the Fuel Industry.*** A capacity of 110 mw was administered by local provincial or autonomous republic organizations, and the remaining capacity, 360 mw, was located in power plants of industrial enterprises, over one-half of which were at coal mines or textile mills.

The net value of fixed assets in the electric power industry in Communist China at the end of 1952 is estimated at 2,320 million yuan. Of this amount, almost 80 percent, or 1,785 million yuan, was in plants and facilities of the Main Control Bureau for Electric Power of the Ministry of the Fuel Industry, and 535 million yuan were in power plants of other jurisdictions.

The cost of replacing facilities in existence at the end of 1952 would have been about 4,030 million yuan (on the basis of reproducing former facilities in yuan values of 1955). The Chinese Communists are believed to have depreciated the fixed assets of the electric power industry by an average of more than 40 percent for the nation as a whole. Installations in the Northeast had been

* The plant factor is the rate of use of the existing facilities in an installation.

** Estimated total capacity is based on the total of individual plants believed to be subordinate to the Main Control Bureau.

*** For description, see Appendix A.

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built fairly recently. Assets are believed to have been depreciated about 40 percent in the Northeast and about 45 percent within the boundaries of China proper.* On an estimated average age per plant of 10 years, this rate of depreciation is about 4 percent annually.

2. Geographic Distribution.

The total fixed assets of the electric power industry in Communist China were distributed very unevenly throughout the country in 1952, reflecting the concentration of factory industry. There were four main concentrations of the electric power industry in China -- two in the Northeast, one in the North, and one in the East. More than one-half of the fixed assets of the electric power industry was estimated to be in the Northeast, where two modern, fairly well integrated power systems had been built by the Japanese.** These two systems provided about 21 percent of the operating capacity of the country. Fixed assets of the electric power industry in other regions of China were concentrated mainly in the Peking-Tientsin (T'ien-ching) and Shanghai areas of the North and East regions, respectively. The USSR had removed generating equipment with a capacity of 1,008 mw, or 60 percent of the total capacity in the Northeast region. Foundations and buildings were still usable, and the plants continued to operate with the remaining equipment. Also operable were the transformer stations, switching stations, and rail spurs.

All the power plants with a capacity of 50 mw and more were concentrated in the Northeast, North, and East; no other regions had any comparable power plants. Eighty-six percent of the electric power industry was in these three regions.

3. Type of Fixed Assets and Country of Origin.

It is estimated that 40 percent of the fixed assets of thermal power plants and 20 percent of the fixed assets of hydro-electric power plants and transmission systems in Communist China in 1952 represented investments in equipment. 11/ These percentages

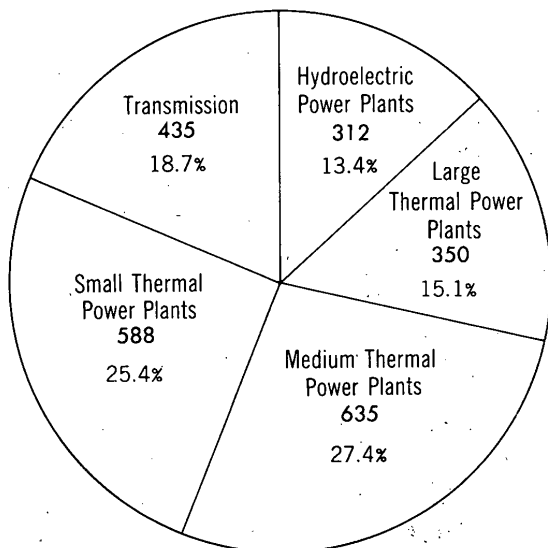
* The term China proper refers to all parts of Communist China except the Northeast region (formerly Manchuria). The regions mentioned in this report are shown on the map, Figure 1, inside back cover.

** See Tables 2 and 3, Appendix B, pp. 31 and 32, respectively, below; the map, Figure 1, inside back cover; and Figure 2, following p. 6.

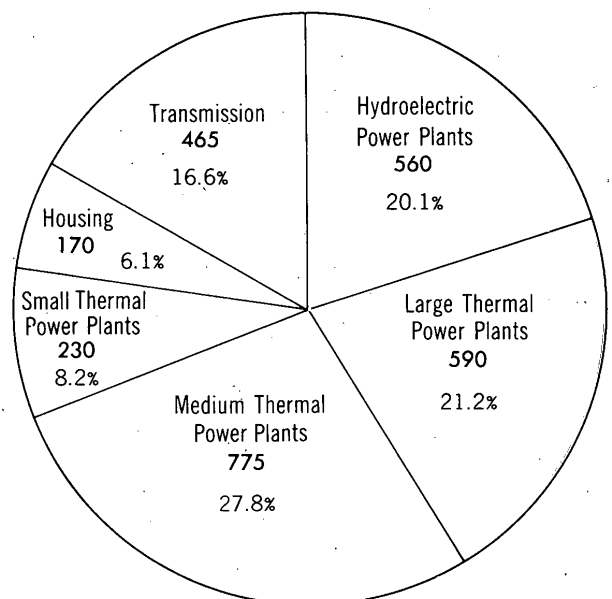
Figure 2 50X1

COMMUNIST CHINA
ALLOCATION OF FIXED ASSETS OF THE ELECTRIC POWER INDUSTRY
BY TYPE OF STRUCTURE, 1952 AND 1953-57
(Million Yuan)

END - 1952



ADDITIONS - 1953-57



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total about 780 million yuan, or one-third of the total fixed assets. The other two-thirds of the fixed assets at the end of 1952 were invested in structures of some sort: dams, earthworks, transmission lines, buildings for power plants, and improvement of land.

All equipment and an unknown number of the structures had been purchased outside China, and replacement parts had to be imported.* Japanese equipment was found in the areas formerly occupied by Japan, and equipment from the West predominated in the port areas along the seacoast and on the major rivers.**

III. First Five Year Plan (1953-57).

A. Analysis of the Plan.

The First Five Year Plan for electric power in Communist China was a complex proposal that presented a program for growth of electric power capacity which would extend into the middle of the Second Five Year Plan. Figures were presented not only for the capacities to be reached by 1957 but also for the total program, which included power capacities to be under construction but not yet in operation by the end of 1957. In addition, other power facilities not included in the plan for power were to be constructed by other ministries.

1. Total Construction Program.

The plan for the total construction program of the electric power industry, extending beyond 1957, called for the building of plants for the public supply with a capacity of 4,060 mw.*** Of this amount, 3,760 mw would be furnished by 92 above-norm projects.**** In addition to the program for public supply, the coal industry was to construct 6 above-norm power plants; other industries were to build 9 more above-norm power plants; and 2 power plants were to be started in Tibet with special funds. In all, 109 above-norm power plants were to be completed or in process of construction. Besides these projects, the power industry was to construct 15 above-norm transmission line projects and transformer stations.

* See Table 4, Appendix B, p. 32, below.

** See Table 5, Appendix B, p. 33, below, and Figure 3, following p. 8, below.

*** See Table 6, Appendix B, p. 34, below.

**** An above-norm project for electric power stations is a plant requiring an investment of 5 million yuan or more. 12/ Generally speaking, this amount would build a power plant with a capacity of about 2 mw, or reconstruct a power plant with a capacity of about 5 mw, except in remote areas, where the costs would be higher.

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2. Capacity to Be Placed in Operation by 1957.

Plans called for increasing the total generating capacity for electric power in China from 2,030 mw at the end of 1952 to close to 4,080 mw by the end of 1957.* 13/ This doubling of capacity was to be accomplished by the rehabilitation or construction of 54 large and medium above-norm power plants with a total capacity of 1,740 mw for the public supply and the addition of a total capacity of 310 mw in other power plants. Of the above-norm plants, 32 were to be large plants and major construction projects of the Ministry of the Electric Power Industry** with a capacity of 1,710 mw, and 22 were to be medium-size power plants with a total capacity of 30 mw and be local-state operated. 15/

3. Regional Growth.

The First Five Year Plan had a twofold purpose in regard to the geographical distribution of industry. The existing industrial bases in the Northeast and near Shanghai were to be reconstructed and extended. New industrial bases were to be established in the interior, both to be nearer sources of raw materials and to be more secure in case of attack. 16/ Reconstruction of existing installations was to predominate before 1957; expansion to new areas was to follow in later years.

The changes in the regional distribution of electric power capacity reflect the shift in regional emphasis on industrial growth. An indication of the slow shift to the interior was the report that although 65 percent of installed capacity was in the seacoast provinces in 1952, only 40 percent of the increase under the plan would be there, so that by 1957 about 50 percent of total capacity would be in the interior.*** 17/

B. Investment Under the Plan.1. Total Capital Investment.

Under the First Five Year Plan the estimated capital investment in the electric power industry**** of Communist China was

* See Table 7, Appendix B, p. 35, below.

** The Ministry of the Fuel Industry was reorganized in June 1955, and the former Main Control Bureau for Electric Power became the Ministry of the Electric Power Industry. 14/

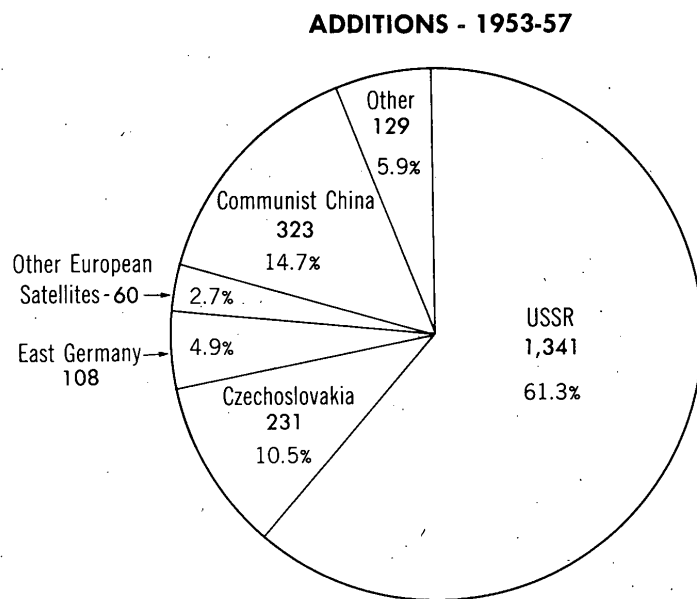
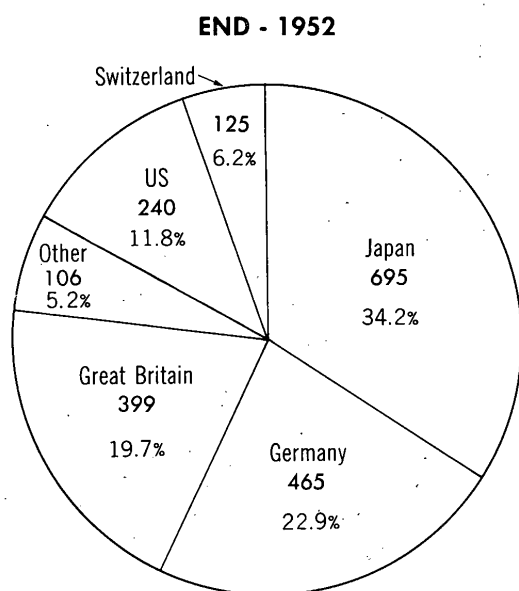
*** See Table 8, Appendix B, p. 36, below.

**** For definitions of capital investment and electric power industry, see Appendix A.

Figure 3

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COMMUNIST CHINA
ORIGIN OF EQUIPMENT INSTALLED
BY THE ELECTRIC POWER INDUSTRY, 1952 AND 1953-57
(Megawatts)



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3,400 million yuan.* This amount was about 2 percent higher than the 3,330 million yuan originally planned. This capital investment is estimated to have been about 7 percent of total national capital investment, 14 percent of industrial capital investment, and 39 percent of capital investment in the fuel industries -- electric power, petroleum, and coal.** During the period of the plan the investment in electric power rose from 6 to 10 percent of the total national capital investment and from 14 to 18 percent of the industrial capital investment. A similar trend in the proportion of investment in electric power to total investment is found in the USSR, 18/ in the US, 19/ and presumably in all countries with a growing industrial economy.

The rate of investment in the electric power industry accelerated greatly between 1950 and 1953. In 1954 the rate of investment slowed, mainly because of the overextension of investment during the first year of the plan. The steady growth of capital investment between 1955 and 1957, although at a declining rate, represents a trend that probably will continue. Capital investment increased from 850 million yuan in 1956 to 1,110 million yuan in 1957. At the same time, additions to new capacity dropped from 617 mw to 555 mw because of the large investment in additions to future capacity. About 757 million yuan were spent under the First Five Year Plan for projects not to be in operation until 1958 or later. Most of this amount was spent during 1957, with approximately 443 million yuan being spent on the construction of 12 large thermal power plants which are to go into operation after 1957.

2. Investment Allocated by Government Agency.

The Ministry of the Electric Power Industry in Communist China, which constructs and operates all major power facilities serving the public supply, invested about 2,900 million yuan of the 3,400 million yuan and added approximately 1,910 mw to existing capacity under the period of the First Five Year Plan.*** This investment also permitted the partial construction of facilities which will go into operation during the first part of the Second Five Year Plan.

Between 1953 and 1957 the government allocated about 150 million yuan for local power plants which were, to be built and run by

* See Table 9, Appendix B, p. 37, below. For methodology, see Appendix C. The methodology and figures used in the derivation were such that no margin of error could be established.

** See Tables 10 and 11, Appendix B, pp. 38 and 40, respectively, below, and Figure 4, following p. 10, below.

*** See Table 12, Appendix B, p. 40, below.

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the local provincial or autonomous republic governments. Investments in these plants were made by the local units from their own budgetary allocations, which are listed separately from the budgetary allowances of the central government.

Various industrial ministries have spent about 350 million yuan, including 150 million yuan by the Ministry of the Coal Industry, on the construction of power plants. Industrial power plants often are built with funds allocated to the parent ministry when the power plant will serve that ministry primarily. According to the First Five Year Plan, 6 above-norm power plants for coal mines and 9 above-norm power plants for other industries with a total capacity of about 160 mw were to be built by 1957. 20/ Below-norm plants would provide an additional capacity of 47 mw.

3. Reconstruction and New Construction.

In allocating capital investment to the electric power industry in Communist China, the Chinese had to consider three major problems: (a) whether to rehabilitate or reconstruct* power plants formerly operating or to build new plants; (b) whether to build small isolated plants or several large regional plants connected with high voltage transmission lines; or (c) whether to construct hydroelectric power plants or to construct thermal power plants.

The least expensive method of increasing production of electric power was to rehabilitate or reconstruct existing power plants. Because the Chinese Communists were concerned primarily with reestablishing the industrial base as soon as possible, they considered this means first. Although no figures are available from Communist China on the comparative costs of rehabilitation and reconstruction as opposed to costs for construction of new plants, the reported cost of repairing old equipment required an average of only 20 to 40 percent of the funds needed to construct a new plant. 21/ Replacing old equipment with new, as was done in reconstruction, must have cost somewhat more. On the basis of US engineering practice the cost of reconstruction is estimated at about one-half as much as new construction. Most of the reconstruction was completed during the course of the First Five Year Plan, but some will not be available until after 1957.

During the period 1953-57 the Chinese Communists spent about 576 million yuan, or 17 percent of the total investment,** on reconstruction

* Rehabilitation consists of placing in operation a plant and its equipment which are already in place but which are in need of repair. Reconstruction consists of putting new equipment into a power plant already in operation.

** See Table 13, Appendix B, p. 41, below.

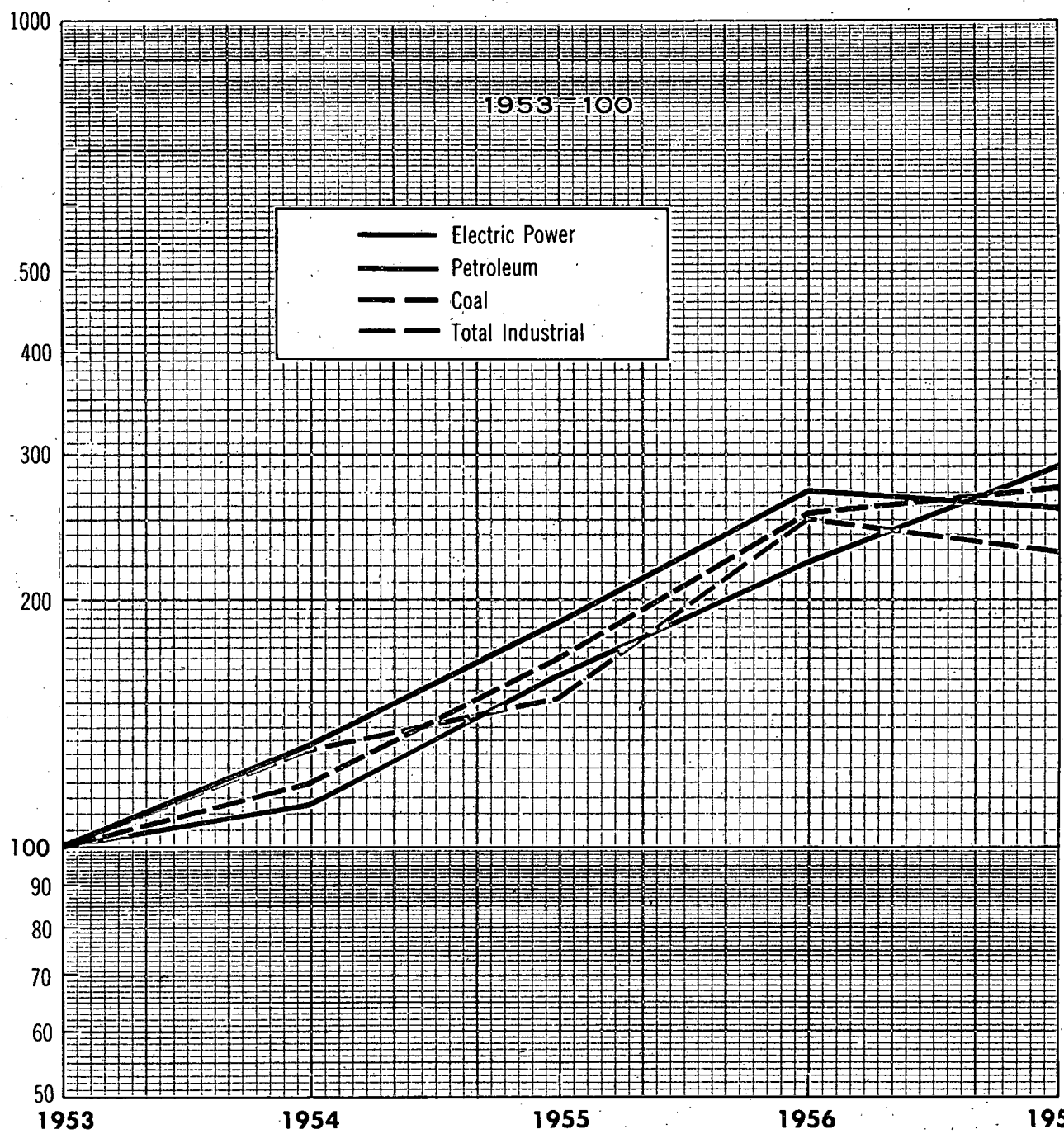
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Figure 4 50X1

COMMUNIST CHINA

INDEX OF THE GROWTH OF CAPITAL INVESTMENT
IN SELECTED INDUSTRIES, 1953-57



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of power plants and other facilities and thus restored to operation a generating capacity of 929 mw, or about 42 percent of the total capacity added during the 5 years.*

A major part of the reconstruction undertook to restore 765 mw in Northeast China, or three-fourths of the generating capacity removed from the region by the USSR. In that region was the Ta-feng-man hydroelectric power plant, the largest in China. In undertaking the restoration the Chinese Communists found the dam and the power house intact but needing repair. For an expenditure of 237 million yuan, 7 percent of the total capital investment, the Chinese restored to operation 353 mw, or 16 percent of the total operating capacity added between 1953 and 1957, at a cost equal to 60 percent of the cost of a new plant. The best investment in terms of capacity acquired for money spent was the addition of 150 mw at each of two large thermal plants, Fu-shun and Fou-hsin in the Northeast, at a total cost of about 150 million yuan. This expenditure added 14 percent of new capacity for 4 percent of the capital investment.

New construction was, of course, much more expensive than the restoration of existing plants. Approximately 2,067 million yuan, or 61 percent of total investment, was spent for new power plants and facilities that went into operation by the end of 1957. These new plants added a capacity of 1,263 mw, or 58 percent of the total new capacity.

Finally, 757 million yuan, or 22 percent of total investment, was expended for new construction that was not to go into operation until after 1957. As the plan progressed, the steady increase in the average size of new power plants dictated a continually lengthening construction period and consequently a greater proportion of investment allocated to uncompleted projects.

4. Size, Distribution, and Interconnection of Electric Power Plants.

The decision as to whether to build many small isolated power plants or several large interconnected power plants depends to a great extent upon the geographic configuration and the degree of development of the consuming industries. As industry becomes more concentrated and consumes more power, construction of larger central power plants becomes economically justified. With the construction of larger power plants the unit cost of the plant decreases. The investment in a large central power plant is less not only because

* See Table 14, Appendix B, p. 42, below.

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larger plants cost less per unit of installed capacity but also because with the interconnection of a large number of load centers, peak loads occur at different times, thus reducing the total capacity needed.

For example, a power plant with a capacity of 100 mw serving 20 small towns in Communist China would cost about 120 million yuan for the power plant and 40 million yuan for the transmission lines and substations. By comparison, 20 small isolated power plants would need no transmission lines or separate substations, but they would need about 20 percent more capacity because power could not be shifted from area to area as peak loads change. Construction costs would be about 50 percent more per megawatt than those of a single large plant. The total expenditure to assure the same amount of power supply would be about 216 million yuan, or 35 percent more than the large central power plant plus transmission. The Chinese Communists apparently have found the construction of large central stations economically justifiable, for the Second Five Year Plan reveals the predominance of large power plants scheduled for construction -- a fact which indicates that the electric power industry will mature much more rapidly between 1957 and 1962 than it did between 1953 and 1957.*

5. Hydroelectric Power Plants Versus Thermal Power Plants.

Under the First Five Year Plan the Chinese Communists concentrated on thermal power plants which could be built more quickly rather than on hydroelectric power plants which could produce power more cheaply. Even though the thermal power plant could make power available in a shorter period of time, this type of plant consumes large amounts of fuel, resulting in a higher cost per unit of electricity. Construction of a hydroelectric power plant is more expensive initially, must be tailored to the location, and frequently necessitates long and expensive transmission lines to centers using power; yet the unit cost of producing electricity is invariably less than that in a thermal power plant.

The long-range economic advantage of a hydroelectric plant is illustrated by comparing an average thermal power plant with a capacity of 50 mw and producing 250 million kwh per year with a hydroelectric power plant capable of producing a similar amount of power. The cost of constructing the thermal power plant would be 60 million yuan compared with 91 million yuan for the hydroelectric plant. The annual cost of producing power by the thermal power plant would be 15 million yuan and about 3 million yuan for the hydroelectric power plant.** Thus the added investment

* See Table 15, Appendix B, p. 43, below.

** Assuming that production costs would be about two-thirds of the selling price. Thermal power for industrial use sold for 0.10 to 0.24 yuan per kilowatt-hour in Kirin Province in 1953 and 1954, and hydroelectric power for industrial use sold for 0.02 yuan per kilowatt-hour. 22/

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cost to build the hydroelectric power plant would be defrayed in about 2 1/2 years.

The differential in investment for power plants is not so great in Communist China as in some other countries. In the USSR the cost of a large hydroelectric power plant is 2 to 5 times that of a comparable thermal power plant. In the US, hydroelectric power plants usually cost about twice as much as thermal power plants. In Communist China, however, hydroelectric power plants currently under construction cost about 40 to 50 percent more per installed kilowatt than do comparable thermal power plants. The medium-size Shih-tzu-tan hydroelectric power plant in Szechwan, for instance, cost 1,820 yuan per kilowatt; ^{23/} whereas a comparable thermal power plant would cost about 1,200 yuan per kilowatt. ^{24/} The large San-men hydroelectric power plant in Honan, scheduled to be constructed under the Second Five Year Plan, is expected to cost 1,380 yuan per kilowatt, ^{25/} whereas a comparable thermal plant would cost 1,000 yuan per kilowatt. ^{26/}

The advantages for Communist China of investing in hydroelectric power plants may be explained partly by three factors, as follows:

First, the comparatively low cost of hydroelectric plants may be due to the manner of allocating the costs of developing hydroelectric power to flood control and irrigation, navigation, and power. In China, where land reclamation receives large amounts of money, more emphasis is placed on the nonpower aspects of a hydroelectric installation. ^{27/} The budget for land reclamation may absorb much of the expense incurred for the earthwork and resettlement, which can be as high as three-fourths of the total investment. In the USSR, on the other hand, the Ministry of Electric Power Stations invariably pays the major part of the bill. ^{28/}

Second, ideal sites for building hydroelectric power plants in Communist China -- natural configurations of narrow gorges with great potential heads of water -- are practically undeveloped. The cost per kilowatt installed would be extremely inexpensive provided the site is not so remote from consuming areas that costs of transmitting the power would be prohibitive. For this reason, Li Jui, Assistant Minister of the Electric Power Industry, predicts that in the foreseeable future construction of hydroelectric power plants may cost only 50 percent more than construction of thermal power plants, not 2 to 8 times as much, as in some areas of the world. ^{29/}

Finally, a great proportion of the cost of a hydroelectric power plant, sometimes as much as two-thirds, is for earthmoving.

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If this preparation can be made more cheaply by conscript coolie labor, the cost of the hydroelectric power plant decreases accordingly.

The Chinese Communists found it advantageous, however, to build thermal power plants during the early part of the First Five Year Plan. Once they had partly restored the industry, they could devote further investment to construction of hydroelectric power plants. Of a capital investment of 2,748 million yuan in power plants between 1953 and 1957, 609 million yuan, or about 20 percent, 30/ were spent for hydroelectric power plants and 2,139 million yuan for thermal power plants.* For new construction alone the Chinese Communists spent 372 million yuan for hydroelectric power plants compared with 1,845 million yuan for thermal power plants.

In view of the demonstrated advantage of hydroelectric power over a long period of time in Communist China, the emphasis upon developing thermal power under the First Five Year Plan and the early years of the Second Five Year Plan must be attributed to three considerations. First, no adequate survey of sites for hydroelectric power plants was completed until 1955. 31/ Second, the longer time required for construction of hydroelectric power plants per unit of installed capacity dictates that the economic planners, whose goal was rapid expansion, must of necessity think of short-term expenditures regardless of long-term considerations. Third, an economy which is short of investment funds will choose projects with a low capital-output ratio rather than those with a low input-output ratio.

C. Additions to Fixed Assets.

Of the capital investment in the electric power industry (3,400 million yuan), additions to fixed assets absorbed about 2,790 million yuan.** Of the latter figure, 2,390 million yuan represented additions to fixed assets of the Ministry of the Electric Power Industry.

At the end of the First Five Year Plan the fixed assets of the electric power industry amounted to about 5,110 million yuan, of which 4,175 million yuan were in assets of the Ministry of the Electric Power Industry. Of the 5,110 million yuan, it is estimated that 4,040 million yuan, or 79 percent, was in power plants; 170 million yuan, or 3 percent, in housing; and 900 million yuan, or 18 percent,

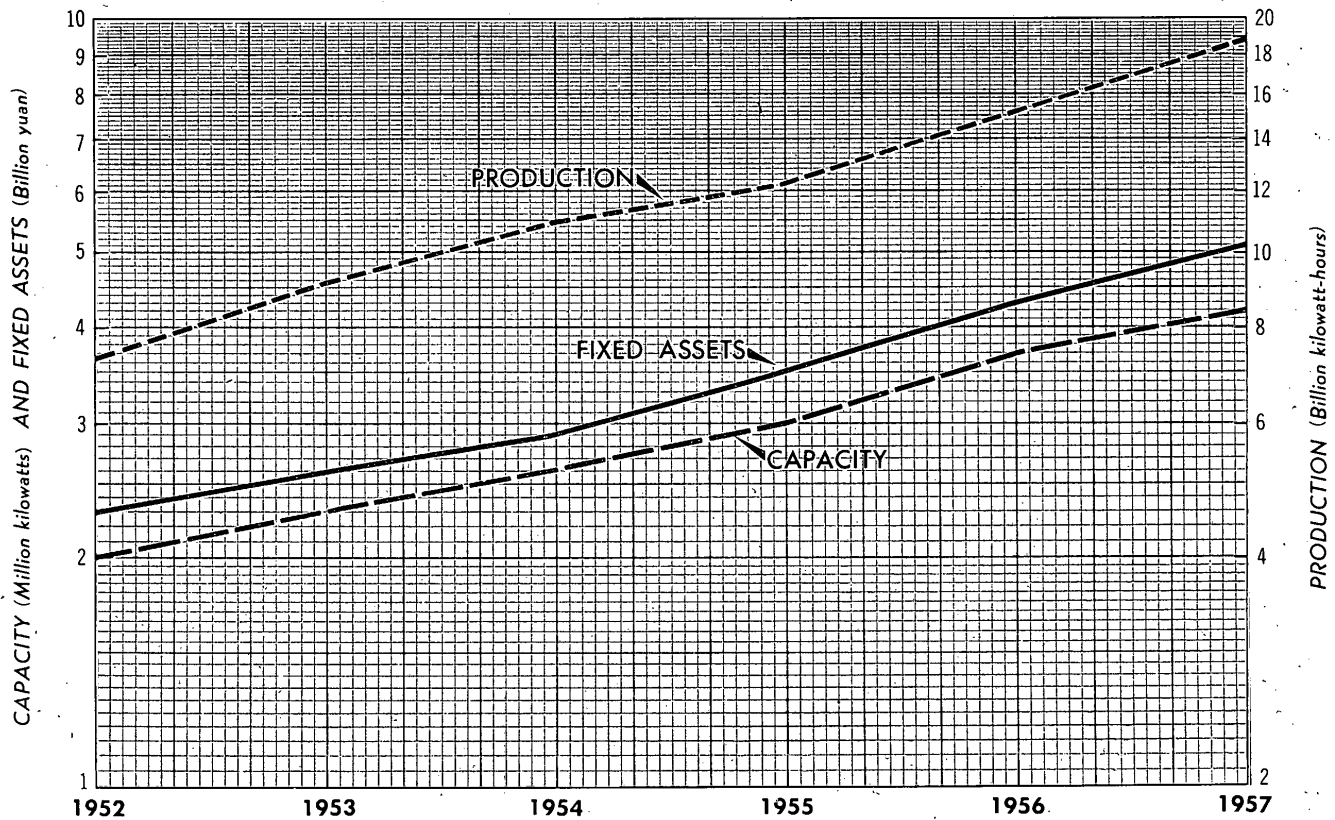
* See Table 13, Appendix B, p. 41, below.

** See Table 16, Appendix B, p. 44, below; Figure 2, following p. 6, above; and Figures 5 and 6, following p. 14. Capital investment becomes an addition to fixed assets when the plant in which the investment is made goes into operation. For definitions, see Appendix A.

Figure 5

50X1

COMMUNIST CHINA
GROWTH OF CAPACITY, PRODUCTION, AND FIXED ASSETS
OF THE ELECTRIC POWER INDUSTRY, 1952-57
(In absolute terms)



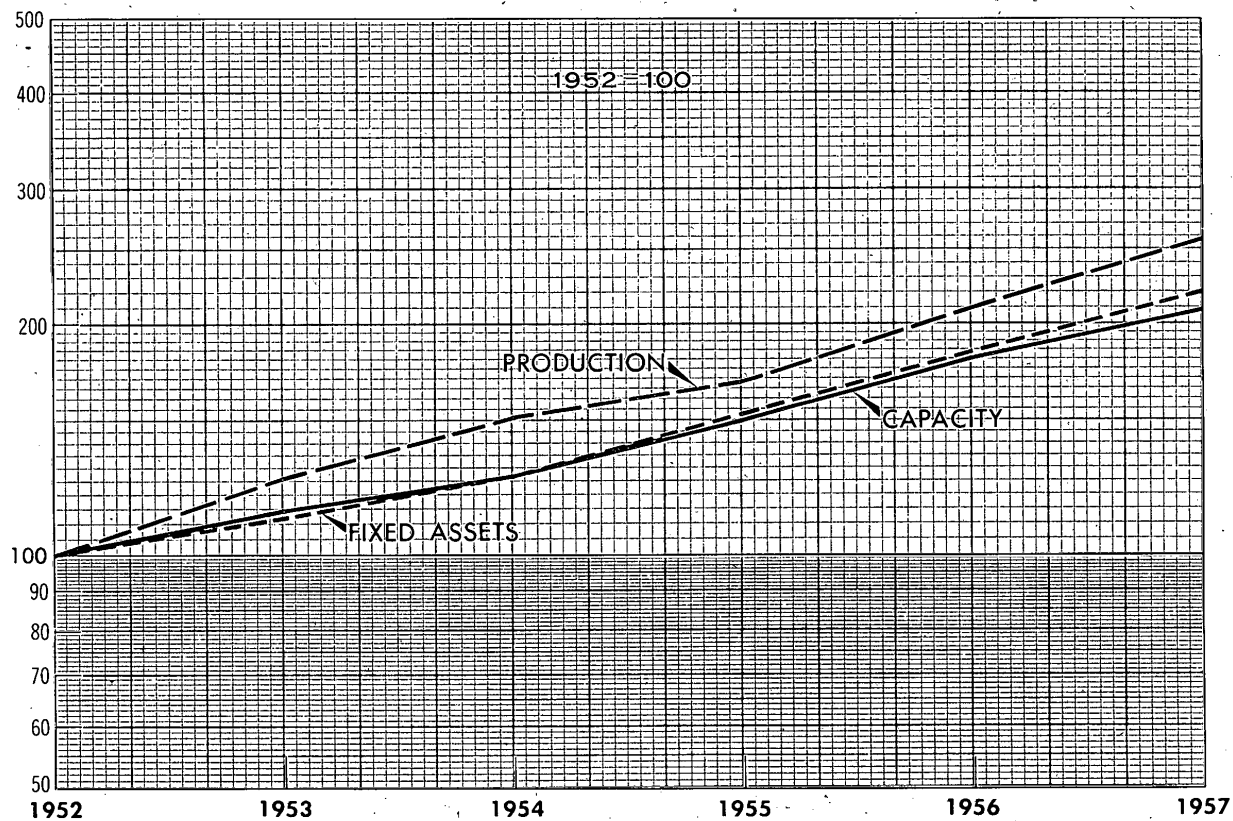
50X1

COMMUNIST CHINA

Figure 6

50X1

INDEX OF THE GROWTH OF CAPACITY, PRODUCTION,
AND FIXED ASSETS OF THE ELECTRIC POWER INDUSTRY, 1952-57



50X1

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in transmission facilities. Investment in housing for workers was negligible in 1952 but, following Soviet practice, has been added as part of the fixed assets of the industry under the First Five Year Plan. An estimated breakdown of additions to fixed assets during 1953-57 by type of structure follows:

<u>Type of Structure</u>	<u>Fixed Assets (Million Yuan)</u>
Power plants	
Hydroelectric	560
Thermal	
Small (less than 8 mw)	230
Medium (8 through 49 mw)	775
Large (50 mw and more)	590
Total	<u>1,595</u>
Housing	170
Transmission facilities	465
Grand total	<u><u>2,790</u></u>

D. Capital Equipment:1. Allocation of Investment to Equipment and Structures.

Of the capital investment in the electric power industry of Communist China under the First Five Year Plan, approximately 38 percent, or 1,300 million yuan, was allocated for the purchase and installation of equipment, and 62 percent, or 2,100 million yuan, for the construction of buildings, dams, and other structures.*

Investment in buildings and structures appears disproportionately large for three reasons: first, hydroelectric power plants require large structures; second, investment in housing is wholly for buildings and structures; and, third, investment in uncompleted projects is almost wholly in buildings and structures because structures are completed before equipment is purchased or installed.

* See Table 17, Appendix B, p. 45, below, and Figure 2, following p. 6, above.

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2. Sources.

Most of the capital equipment installed in the electric power industry and an unknown number of structures were purchased outside China. Even replacements were imported. Estimates as to quantity and country of origin* of the equipment installed can be made only for generating equipment, but it is assumed that other equipment originated in approximately the same pattern. It is estimated that 62 percent of the generating equipment installed was imported from the USSR and 18 percent from other countries of the Soviet Bloc. China itself produced or reinstalled 15 percent of the total capacity introduced. The remaining 5 percent -- equipment shipped originally to the Nationalists and captured and installed by the Communists -- came from the Free World.

While the USSR furnished by far the major part of the generating equipment for the electric power capacity completed through 1955, the European Satellites and Communist China together supplied as much as the USSR for the years 1956 and 1957. In general, the Satellites and China have supplied small and medium-size generating equipment with capacities of 24 mw or less, and the USSR has supplied the larger equipment with capacities of 25 mw or more.

3. Payment.

Expenditures for capital equipment can be estimated only.** It is not known, for instance, how much the USSR is charging Communist China to reinstall the equipment taken from China in the first place. Because Soviet and Chinese officials generally maintain the fiction that this equipment has been newly manufactured by the USSR, the USSR presumably is charging full price.

The price which Communist China was to pay for the equipment and technical aid was set forth in contractual agreements between the trade organizations of that nation and the country furnishing the aid. The process of payment was by the usual intra-Bloc clearance. On the basis of a few examples of comparative costs of equipment in China and the rest of the world, the Chinese Communists apparently are paying twice as much, in terms of yuan, for the power plants as they would pay at the official rate of exchange.

It is estimated that the Chinese Communists paid about 800 million yuan to the USSR for equipment installed and placed in operation

* See Table 18, Appendix B, p. 46, below, and Figure 3, following p. 8, above.

** See Table 19, Appendix B, p. 47, below.

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during 1953-57. The total payments to the USSR must have been considerably higher because much material and technical aid also was furnished.

E. Indexes of Growth of the Industry.

As a result of investment in the electric power industry, it is estimated that total power capacity in Communist China increased from 2,030 mw in 1952 to 4,220 mw at the end of 1957. This figure reveals a growth of 2,190 mw, or 108 percent, during the 5 years compared with the original plan of 2,050 mw.* Of the total increase in capacity, it is estimated that power plants of the Ministry of the Electric Power Industry supplied 1,910 mw, or 87 percent, and that local and industrial power plants accounted for 280 mw, of newly installed capacity. The capacity of hydroelectric power plants increased 540 mw during the period 1953-57 compared with an increase of 1,652 mw in thermal power plants.** Thus 75 percent of the new capacity was in thermal power plants.

During the same period the plant factor was scheduled to be increased to about 48 percent.*** Actual production in 1957 was 18.9 billion kwh, and average capacity was about 3,950 mw. This rate is an average annual use of 4,790 hours per year and a plant factor of 55 percent. A national factor of 57 percent, as in the US and the USSR, may be, practically speaking, about the top level possible economically in modern industrialized countries.

The increase in the rate of utilization generally would result not from stepping up the use of the older equipment but from intensive use of the newly installed equipment.**** Before 1954 the older equipment had to be relied upon for increases in production, but after 1954 rapid increases in new capacity permitted the older equipment to be run at a steadily decreasing plant factor, giving adequate time for maintenance.

* See Table 20, Appendix B, p. 48, below, and Figures 5 and 6, following p. 14, above.

** See Table 21, Appendix B, p. 51, below, and Figures 5 and 6, following p. 14, above.

*** See Table 22, Appendix B, p. 52, below. Capacity at the end of 1957 was scheduled to be 4,080 mw. Assuming that the average capacity for the year was 3,780 mw, based on a planned production of 15.9 billion kwh, an annual average use of 4,200 hours, or 48 percent, was obtained.

**** See Table 23, Appendix B, p. 52, below.

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Under the First Five Year Plan, production of electric power in Communist China increased at an average annual rate of 21 percent.* The production of 18.9 billion kwh achieved in 1957 compared with 15.9 billion kwh specified in the original plan. Production increased 160 percent over the level for 1952, an increase during the 5 years of 34 percent more than the 119 percent originally specified in the plan. If the amount of power imported into Northeast China from the reconstructed hydroelectric power plant at Sup'ung were added to the 18.9 billion kwh produced in China, total gross consumption in 1957 would amount to about 20.5 billion kwh, an increase of 180 percent during the 5-year period of the plan.

The growth in total consumption of electric power in Communist China is spectacular when compared with rates of increase in selected industrialized countries at the present time, although the rate is not so rapid as was that of the USSR between 1928 and 1933.**

The reasons for the rapid growth probably are to be found in a concatenation of several factors: the forced industrial investment program possible in a totalitarian state, the existence of a native raw material base upon which to build the growth, the relatively low level of industrial development, a higher return on capital invested, the extensive technical aid furnished by the Soviet Bloc, and the emphasis upon heavy industries which consume large quantities of power.

The fact that production of electric power in 1957 exceeded the original plan by 3.0 billion kwh can be attributed only in part to over-fulfillment of the plan for industrial production. According to Liu Ian-po, Minister of the Electric Power Industry, the main reasons for such a great increase over the plan are to be found in the improper projection and allocation of power requirements. This statement is interpreted to mean that the Chinese economy apparently is using power at a greater rate per unit of industrial output than was anticipated. The plan, as originally drawn up, probably was based on Soviet plan factors, because little information regarding specific inputs of electric power per unit of industrial output was available in China in 1952. A brief comparison of some Soviet norms with Chinese consumption will illustrate the pattern.***

Comparative rates of growth of production, capacity, and fixed assets reveal that increases in production exceeded growth in capacity as a result of more intensive use of existing plant facilities.****

* See Table 24, Appendix B, p. 53, below, and Figures 5 and 6, following p. 14, above.

** See Table 25, Appendix B, p. 54, below.

*** See Table 26, Appendix B, p. 55, below.

**** See Figures 2 and 3, following pp. 6 and 8, respectively, above.

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Less apparent but nevertheless discernible was the fact that additions to capacity tended to keep pace with additions to fixed assets between 1953 and 1955. The tendency in 1956 and 1957 was to add to capacity more slowly than to increase fixed assets because the cost of building new plants was greater than that of reconstructing old ones.*

F. Contribution to the Gross National Product.

The contribution of the electric power industry of Communist China to the gross national product (GNP) in 1957 is estimated to be about 1.86 percent of the total GNP and 10.3 percent of the contribution of all industry.** The proportional contribution of the electric power industry to the GNP increased steadily under the First Five Year Plan, as did that of factory industry in general, reflecting the rapid industrialization of the country. Moreover, in the last 2 years of the First Five Year Plan, the electric power industry also increased its proportion of the contribution of all industry to the GNP. This development probably resulted from increasing modern power-intensive industry and placing in operation modern mechanized plants in the last few years. During 1952-55 the contribution of the electric power industry to the industrial sector of the GNP remained close to 8.7 percent.

IV. Second Five Year Plan (1958-62).

The fundamental task of the Second Five Year Plan, according to Chou En-lai's report, will be to increase the production of heavy industry to more than double the levels planned for 1957. 32/ At the Eighth National Party Congress in September 1956, Liu Ian-po, Minister of the Electric Power Industry, outlined the plan to achieve this increase.*** Under this plan the Chinese Communists anticipate that total industrial production will increase only 9 percent per year but that production of electric power will increase 18 percent per year. Liu gave no figures on the investment needed to support the goals for electric power, but it is estimated that about 8,200 million yuan, or 140 percent more than the 3,400 million yuan invested under the First Five Year Plan, will be invested in the electric power industry. Of this amount, 7,200 million yuan will be spent by the Ministry of the Electric Power Industry. The value of the fixed assets is expected to grow from 5,100 million yuan to 11,700 million yuan, an increase of 6,600 million yuan compared with an estimated increase of 2,300 million yuan to 5,100 million yuan in the earlier 5-year period.****

* See discussion in III, B, 3, p. 10, above.

** See Table 27, Appendix B, p. 56, below.

*** See Table 28, Appendix B, p. 57, below.

**** See Table 29, Appendix B, p. 58, below.

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In a later speech, Liu stated that capacity would increase at a rate 35 percent faster than the planned rate of about 120 percent for production. 33/ Realization of this plan would mean an increase of 165 percent in capacity and a total increase of about 7,000 mw. About 4,000 mw would be in thermal power plants and about 3,000 mw in hydroelectric power plants. 34/ Liu went on to say that the Second Five Year Plan calls for the construction of 9 hydroelectric power plants, each with a capacity of more than 300 mw. 35/

The complete program outlined by Liu for the entire electric power industry probably will not be met. He expects capacity to increase 50 percent faster than it did under the First Five Year Plan, although the increase will be measured from a base twice as large as that in 1952.

The program for the construction of thermal power plants is believed to be reasonable. The increase of 114 percent in thermal power is large, but more than 80 percent of the increase, 3,250 mw, is accounted for tentatively in plants known to be under construction, contracted for, or under discussion. The program for the construction of hydroelectric power plants seems overly ambitious for three reasons, as follows:

First, the investment necessary for such a program is believed to be beyond the capability of the Chinese Communists. The rapid rate of increase in hydroelectric capacity during 1953-57 was mainly a function of the small base with 80 percent of the increase accounted for in the reconstruction of the Ta-feng-man hydroelectric plant. The increase during 1958-62 will be almost exclusively in more expensive new construction.

Second, in view of the fact that a hydroelectric power plant with a capacity of 300 mw or more takes about 4 or 5 years to build according to US and Soviet construction practices, it seems unlikely that power plants not already started would be in complete operation before 1962. At the present time only three hydroelectric power plants with a capacity of more than 300 mw are known to be under construction. They are the Hsin-an hydroelectric power plant, with a capacity of 576 mw, scheduled for completion in 1961, to serve Shanghai 36/; the San-men hydroelectric power plant, with a capacity of 1,110 mw, scheduled for completion in 1962, to serve Lo-yang 37/; and the I-li hydroelectric power plant development, with a total capacity of 330 mw in four plants, to serve K'un-ming. 38/

Third, with regard to total capacity, it also seems unlikely that Communist China will manage to do what no other rapidly growing industrialized nation has been able to do -- appreciably increase the

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relationship of capacity to production. As power plants in the US 39/ and the USSR 40/ averaged 57 percent utilization in 1955, it seems that China could be expected to approach the same level of utilization of power plants.

Capacity, therefore, probably will grow more slowly than the Chinese are planning. A plant factor of 57 percent by 1962 would require the addition of 5,100 mw to give a total capacity of 9,300 mw.* It seems logical that if the capacity of thermal plants grows as reported, at 800 mw per year, the capacity of hydroelectric plants would increase 1,100 mw to 1,800 mw, or less than one-third as rapidly as the planned development.

Production probably will continue to increase at a rapid rate in spite of efforts to economize, although the rate of growth will not be so great as between 1952 and 1957. It is estimated that the production of electric power will increase 130 percent to 43 billion kwh and that consumption will increase 125 percent to 45.5 billion kwh.

V. Regional Growth of the Industry.

A. General.

Generally speaking, three factors determine the location of electric power plants: the location of existing industry and population centers, the location of natural resources (including fuel reserves and water power resources), and strategic considerations. The first factor is conservative and tends to keep the development of power plants in the regions where industry has been established. The last two factors, as they operate in Communist China, tend to shift the development of power plants to other regions; in turn, industry and population would follow.**

In Communist China the imbalance between the distribution of industry and the distribution of sources of energy is readily apparent.*** Industry developed mainly in the Northeast and East because the economy of the nation was oriented to exports. These two regions accounted for 65 percent of industrial activity in 1952 but contained only 9 percent of the

* The average capacity in 1962 would be 8,600 mw, with about 700 mw installed in the last half of the year.

** A large number of other factors, including transportation, mineral and vegetable resources, and industrial water supply, enter into the decision when locating industry. This report is intended to suggest only the major aspects of the influence of energy resources.

*** See Table 30, Appendix B, p. 59, below.

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coal reserves and 14 percent of the water power resources. The North and the Northwest have only 17 percent of the industry but 85 percent of the coal reserves; the Southwest has only 7 percent of the industry but 57 percent of the water power resources. Because the sources of energy are located in the interior regions* of China, the electric power industry would be expected to gravitate to those regions.

B. First Five Year Plan (1953-57).

Under the First Five Year Plan of Communist China, investment in the electric power industry did not follow entirely the pattern of growth dictated by the distribution of sources of energy, because reconstruction of the existing electric power industry required that considerable investment be channeled into regions where other industries had been established, especially the Northeast.** To that region the government allotted 29 percent of the funds for reconstruction and 16 percent of the funds for new construction. The greatest absolute increase in fixed assets was in the Northeast even though the percentage increase was the lowest of any region.

The greatest rate of increase in fixed assets in the electric power industry occurred in the interior, but the absolute increase was the smallest.*** Expenditures on new construction during 1953-57 amounted to 36 percent of the value of the fixed assets existing in 1952 in the Northeast, 125 percent of the value of such assets in the East, 185 percent in the North, 290 percent in the Central and South, 410 percent in the Southwest, and more than 800 percent in the Northwest.

C. Second Five Year Plan (1958-62).

The development of the electric power industry in China did not begin to follow the pattern of the distribution of sources of energy until the Second Five Year Plan.**** The greatest increase during 1958-62 is expected to be in the North, where the largest coal reserves are located and where the Chinese Communists plan to build 7 large thermal power plants. Those at Shuo-hsien and T'ai-yuan in Shansi

* The interior regions of China are the Southwest, the Northwest, and the Inner Mongolian Autonomous Region.

** See Table 31, Appendix B, p. 60, below, and the map, Figure 1, inside back cover.

*** See Table 32, Appendix B, p. 61, below.

**** See Table 33, Appendix B, p. 62, below.

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Province and at Feng-feng in Hopeh Province will have a capacity of 300 mw or more. Located adjacent to coal mines, these power plants will transmit electricity to load centers over high-tension lines.

The next greatest increase will be in the Central and South region, where the San-men hydroelectric power plant on the Yellow River near Lo-yang will be approaching its ultimate capacity of 1,100 mw by 1962. Other significant increases will promote the development of industry in the older areas. It is estimated that the capacity in the Northeast will be increased by 800 mw, of which 600 mw will be in a large thermal power plant near Shen-yang. The rate of increase in the Northeast will be only 45 percent, less than half the rate in the East. In the latter area, two new power plants, the Wang-ting thermal power plant and the Hsin-an hydroelectric power plant, each with a capacity of more than 300 mw, will add to the supply of power in the Shanghai district. Under the Second Five Year Plan, the interior regions will show the greatest rate of increase in capacity but will fall behind the other regions in absolute growth. Major power plants with capacities of 100 mw or more will be built to serve Ian-chou, Pao-t'ou, Ch'eng-tu, and Chungking.

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APPENDIX A

DEFINITIONS1. Electric Power Industry in Communist China.

The data released by the Chinese Communists for the Ministry of the Electric Power Industry, for power plants owned by the state, and for the total facilities of electric power are frequently confusing. An understanding of the aspects of jurisdiction or ownership of the electric power industry of Communist China is a prerequisite to any analysis of statistics on production, capacity, or investment.

The electric power industry in Communist China as defined in this report* controls facilities for both the production and transmission of electric power but not for distribution. In the US, about 40 percent of the total investment of the electric power industry is in facilities for distribution. Therefore, the electric power industry in Communist China cannot be compared directly with the electric power industry of the US.

The data given for the electric power industry or its components in Communist China probably do not include power plants with a capacity of 500 kilowatts or less. In a report on the industry at the World Power Conference, Chen Chi-yuan, a member of the Central Committee, specifically excepted installations of such size. ^{41/} Thus small portable and mobile power plants for agriculture, land reclamation, and small isolated industries are excluded from the totals.

When the Chinese Communists speak of the "state-owned electric power industry," however, it is believed that they refer only to the Ministry of the Electric Power Industry. The Ministry of the Electric Power Industry has jurisdiction over what is generally considered in the US to be the electric power utilities industry -- that is, public power utilities or power plants which contribute either wholly or mainly to the system for public supply rather than to a specific industrial complex. This jurisdiction is estimated to include 82 to 85 percent of the total power capacity installed in Communist China and an equal percentage of the total production of power. The Ministry of the Electric Power Industry was created by order of the State Council in June 1955 from the Main Control Bureau of the former Ministry of the Fuel Industry, which included the three industries based on energy: coal, oil, and electric power. ^{42/} At the end of July 1955, Liu Ian-po was appointed Minister of the newly created Ministry of the Electric Power Industry. ^{43/}

* See I, A, p. 2, above.

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Since 1953, when the private power companies in Shanghai were nationalized, ^{44/} all electric power plants in Communist China have been owned either by the state or by public-private corporations operated by the state. In addition to the power plants of the Ministry of the Electric Power Industry, the power plants owned by the state include power plants at industrial complexes, such as coal mines, textile mills, and paper plants, and power plants operated locally by the provincial or autonomous republic government. According to the First Five Year Plan, local power plants operated by the state were to produce 3 percent of the total production of electric power in 1957, and plants operated by public-private corporations were to produce 9 percent of the total production for that year. ^{45/} Those power plants operated by industrial complexes and by provincial governments, even though not responsible to the Ministry, submit reports and come under the general guidance and technical supervision of that body.

2. Concepts of Investment Utilized.

In this report a distinction has been made between the stock of fixed capital assets at any one time and the flow of funds into capital investment.* The fixed assets of the electric power industry of Communist China at the end of 1952, for instance, represent the net value of all capital structures of the industry, both productive and nonproductive. Additions to fixed assets in 1952 are the net value of all capital structures finished and turned over for use during the year. They may have been built wholly in 1952; more likely, construction was started and construction expenditures were made in 1951 or earlier.

Capital investment in the electric power industry, on the other hand, represents all expenditures on capital structures of the industry during the year, whether they were turned over for use or not. In any one year, therefore, many capital investments are made which do not become additions to fixed assets until a later year. In an industry which is expanding as rapidly as the electric power industry of Communist China, there is a tendency for capital investment in any one period to be greater than additions to fixed assets. The difference represents inoperative capital assets and tends, in a rapidly expanding economy, to become increasingly greater.

Chinese Communist statistics on investment often are confusing because they are not always clear as to whether they refer to additions to fixed assets or to the flow of funds. The phrase "expenditures for completed basic construction work" is used by the Chinese to refer to expenditures for capital construction completed during the year. The concept closely

* The Chinese Communists make this distinction in their own bookkeeping but not always in their statistics published for public consumption.

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approximates additions to fixed assets. By definition, additions to fixed assets equal expenditures on completed basic construction, plus major repairs, less depreciation. Chinese practice seems to approximate closely US practice in which the depreciation fund is used to cover expenditures for major repairs and therefore depreciation and major repairs cancel each other out in the definition of additions to fixed assets. When the Chinese say "investment," they quite often mean expenditures on completed basic construction.

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APPENDIX B

STATISTICAL TABLES

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Table 1

Rehabilitation of the Electric Power Industry
of Communist China
1949 and 1952

Component	Unit	1949	1952	Increase (Percent)
Capacity at end of year	Megawatt	1,850 <u>a/</u>	2,030 <u>b/</u>	10
Production	Billion kilowatt-hours (kwh)	4.3 <u>c/</u>	7.3 <u>d/</u>	70
Plant factor <u>e/</u> (based on average capacity)	Percent	27	42	56
Gross consumption	Billion kwh	4.9 <u>f/</u>	7.3 <u>g/</u>	49
Net consumption <u>h/</u>	Billion kwh	3.4	5.8	63
Fixed assets	Million yuan	2,180 <u>i/</u>	2,320 <u>j/</u>	6

a. 46/

b. From Table 20, p. 48, below.

c. 47/

d. From Table 24, p. 53, below.

e. Plant factor equals $\frac{100 \times \text{average number of hours of annual use}}{\text{Number of hours in a year, 8,760}}$.

Average number of hours of annual use equals annual production divided by average capacity.

f. Includes 595 million kwh imported from North Korea.

g. Consumption equals production. There were no imports or exports, and electric power cannot be stored in significant quantities.

h. Net consumption is gross consumption less consumption by the electric power industry itself in station use and line loss. In the years 1949 to 1952, station use reportedly was reduced from 7.73 to 5.76 percent of the total, and line loss, from 24.84 to 12.56 percent. 48/ It is not clear whether those percentages refer to total production plus imports, to total production alone, or merely to production by the Main Control Bureau for the Electric Power Industry. In the absence of other data, it has been assumed that the percentages refer to total production plus imports, and the categories possibly not included may well approximate the same percentages.

i. Derived from the figure for 1952 by subtracting the 140 million yuan added to fixed assets in 1949-52. See Table 9, p. 37, below.

j. For methodology, see Appendix C.

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Table 2

Estimated Distribution of Fixed Assets in the Electric Power Industry
of Communist China, by Type of Plant and by Region a/
1952

Region	Thermal Power Plants				Hydroelectric Power Plants	Transmission Facilities e/	Total Assets	Percent of Total
	Small b/	Medium c/	Large d/	Total				
	Million Yuan							
Northeast	110	250	210	570	300	380	1,250	54
North	100	125	30	255	0	55	310	13
East	135	190	110	435	0	0	435	19
Central and South	108	70	0	178	5	0	183	8
Southwest f/	75	0	0	75	5	0	80	3
Northwest	30	0	0	30	2	0	32	1.5
Inner Mongolian	30	0	0	30	0	0	30	1.5
Total	<u>588</u>	<u>635</u>	<u>350</u>	<u>1,573</u>	<u>312</u>	<u>435</u>	<u>2,320</u>	<u>100</u>
Percent of Total	25	28	15	68	13	19	100	

- a. see Appendix C. See Figure 2, following p. 6, above.
 b. Capacity of less than 8 megawatts (mw).
 c. Capacity of 8 through 49 mw.
 d. Capacity of 50 mw and more.
 e. Includes transformer and switching stations.
 f. Includes Tibet.

For methodology,

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Table 3

Major Electric Power Systems of Communist China
1952

<u>Province</u>	<u>Cities Served</u>	<u>Power Base</u>	<u>Percent of Total Capacity ^{a/}</u>
Kirin	Harbin (Ha-erh-pin), Kirin, Ch'ang-ch'un	Ta-feng-man hydroelectric power plant	10
Liaoning	An-shan, Shen-yang	Fu-shun and Fou-hsin thermal power plants	11
Hopeh	Peking, Tientsin	Thermal power plants	9
Kiangsu	Shanghai	Thermal power plants	13

a. Based on additions to the capacities of plants connected to the power system as estimated by CIA.

Table 4

Value of Fixed Assets in Equipment of the Electric Power Industry
of Communist China, by Country of Origin
1952

<u>Origin</u>	<u>Value (Million Yuan)</u>	<u>Percent of Total ^{a/}</u>
Germany ^{b/}	180	23
Japan	260	34
Switzerland	50	6
UK	160	20
US	90	12
Other	40	5
Total	<u>780</u>	<u>100</u>

a. Based on Table 5, p. 33, below.

b. Prewar Germany (1939).

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Table 5

Origin and Location of Generating Equipment of the Electric Power Industry
of Communist China ^{a/}
1952

							Megawatts
Region	Germany ^{b/}	Japan	Switzerland	UK	US	Other	Total
Northeast	169	448	12	30	93	27	779
North	98	97	32	70	3	20	320
East	112	118	45	187	82	43	587
Central and South	57	19	21	55	43	2	197
Southwest	18	0	8	36	16	4	82
Northwest	8	0	4	19	0	3	34
Inner Mongolian	3	13	3	2	3	7	31
Total	<u>465</u>	<u>695</u>	<u>125</u>	<u>399</u>	<u>240</u>	<u>106</u>	<u>2,030</u>

- a. See Figure 3, following p. 8,
above.
b. Prewar Germany (1939).

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Table 6

Analysis of the First Five Year Plan
of the Electric Power Industry of Communist China a/
1953-57

<u>Type of Project</u>	<u>Units to be Added</u>		<u>Increase in Capacity</u>	
	<u>Number</u>	<u>Total</u>	<u>Megawatts</u>	<u>Total</u>
For public supply				
Above-norm projects				
Power plants				
Thermal				
Heat and power	19		1,450 <u>b/</u>	
Condensing	57		1,640	
Total thermal		76		3,090 <u>c/</u>
Hydroelectric	16		670 <u>c/</u>	
Total power plants		92		3,760
Transmission lines				
Transmission lines	10		0	
Transformer stations	5		0	
Total transmission facilities		15		0
Total above-norm projects		107		3,760
Below-norm projects	N.A.		300	
Total for public supply		N.A.		4,060
Outside of public supply <u>d/</u>				
Power plants in coal mines	6		100 <u>c/</u>	
Power plants in other industries	9		120 <u>c/</u>	
Power plants in Tibet	2		2 <u>c/</u>	
Total outside of public supply		17		222
Grand total		N.A.		4,282 <u>d/</u>

a. Except as noted, all figures are from the First Five Year Plan. 49/

b. Heat and power plants were to account for 47 percent of total thermal capacity. 50/

c. Estimate based on additions to the capacities of the plants believed to be included in the plan as above-norm projects.

d. It is not clear from the text of the plan whether the capacity to be added outside of the public supply was included in the total capacity to be added. It is assumed that, inasmuch as the industrial projects were in addition to the projects for public supply, the capacity also was in addition to this supply.

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Table 7

Planned Increases in Capacity of the Electric Power Industry
of Communist China ^a/
1953-57

<u>Type of Power</u>	<u>End of 1952</u>		<u>Planned Increase</u>		<u>End of 1957</u>		1957 as Percent of 1952
	<u>Megawatts</u>	<u>Percent of Total</u>	<u>Megawatts</u>	<u>Percent of Total</u>	<u>Megawatts</u>	<u>Percent of Total</u>	
Thermal	1,840	90.7	1,540	75.0	3,380	82.9	184.0
Hydroelectric	190	9.3	510	25.0	700	17.1	368.0
Total	<u>2,030</u>	<u>100.0</u>	<u>2,050</u>	<u>100.0</u>	<u>4,080</u>	<u>100.0</u>	201.0

a. Total amounts and percentages of hydroelectric power are given in the First Five Year Plan. 51/ The other figures are estimated.

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Table 8

Regional Distribution of Increases in Capacity
of the Electric Power Industry of Communist China ^{a/}
1953-57

Region	Number of Above-Norm Projects ^{b/}			Capacity at End of 1952 ^{c/} (Megawatts)	Planned Increase in Capacity	
	Thermal Power Plants	Hydroelectric Power Plants	Total		Megawatts ^{d/}	Percent ^{e/}
Northeast	8	1	9	779	872	112
North	13	1	14	320	272	85
East	14	3	17	587	188	32
Central and South	14	1	15	197	178	90
Southwest	6	8	14	82	112	138
Northwest	13	2	15	34	192	563
Inner Mongolian	7	0	7	31	78	264
Total	75	16	91 ^{f/}	2,030	1,892 ^{g/}	93 ^{h/}

a. It should be noted that the projects listed are above-norm plants only; that the number of plants does not include power plants in coal mines and other industrial installations; and that the increases in capacity are for the period of the First Five Year Plan only, but that construction of some of the projects will extend into the period of the Second Five Year Plan. Hence, the increases in capacity given in the table can be equated neither to the total planned increase in capacity in the region during the period of the plan, except for purposes of rough approximation, nor to the capacity of all the projects under construction.

b. ^{52/}

c. For methodology, see

Appendix C.

d. Derived from percentage increases.

e. ^{53/}. It is not clear from the text of the plan whether the percentage increases by region are for above-norm plants only, whether they include below-norm plants, or whether they include coal mine and industrial power plants as well as public supply power plants.

f. One mobile power project must be added in order to arrive at the totals given in the plan.

g. This figure does not represent the total increase but probably refers to all plants for public supply.

h. Estimate.

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Table 9

Annual Capital Investment in the Electric Power Industry
of Communist China
1950-57

Year	Indexes		Capital Investment	Increase	Percent of
	1950 = 100	1953 = 100	(Million Yuan)	(Percent)	Total Plan Achieved
Before First Five Year Plan					
1950	100 <u>a/</u>		19 <u>b/</u>		
1951	175 <u>a/</u>		33 <u>b/</u>	75 <u>c/</u>	
1952	462 <u>a/</u>		88 <u>d/</u>	164 <u>c/</u>	
Total	<u>737</u>		<u>140</u>		
Period of First Five Year Plan					
1953		100 <u>e/</u>	380 <u>f/</u>	340 <u>g/</u>	11.5 <u>a/</u>
1954		111 <u>e/</u>	430 <u>f/</u>	11 <u>e/</u>	12.8 <u>a/</u>
1955		163 <u>e/</u>	630 <u>f/</u>	47 <u>e/</u>	18.8 <u>a/</u>
1956		222 <u>h/</u>	850 <u>f/</u>	36 <u>i/</u>	25.6 <u>j/</u>
1957		289 <u>h/</u>	1,110 <u>f/</u>	30 <u>k/</u>	33.3 <u>j/</u>
Total		<u>885</u>	<u>3,400</u>		<u>102.0</u>
Grand total					
1950-57			<u>3,540</u>		

a. Index of capital construction and plan fulfillment. 54/

b. Derived from the index and later figures on investment.

c. Derived from the index.

d. The Main Control Bureau for the Electric Power Industry was to invest 80 million yuan in 1952. 55/ It is assumed that there was a small amount of investment outside the Bureau to coincide with the figures for percentage increases.

e. Index of capital construction. 56/

f. Derived by applying the total of the index for the years 1953-57 to the total of 3,400 million yuan. For methodology, see Appendix C.

g. Planned increase. 57/ Agrees with absolute figures.

h. Derived from the percentage increase.

i. Capital construction by the electric power industry will increase 36 percent. 58/

j. Derived from previous percentages and the index.

k. Investment in capital construction by the electric power industry was to increase 30 percent. 59/

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Table 10

Capital Investment in the Electric Power Industry of Communist China
Compared with Investment in Selected Industries and with Total National Investment
1953-57

							Million Yuan
Category of Investment	Actual Investment						Planned Total
	1953	1954	1955	1956	1957	Total	
Fuel industries							
Electric power <u>a/</u>	380	430	630	850	1,110	3,400	3,330
Petroleum <u>b/</u>	270 <u>c/</u>	360 <u>d/</u>	510 <u>e/</u>	730 <u>f/</u>	700 <u>g/</u>	2,570	2,570 <u>h/</u>
Coal <u>i/</u>	300 <u>j/</u>	360 <u>j/</u>	510 <u>j/</u>	760	820	2,750	2,750
Total fuel	950 <u>k/</u>	1,150 <u>k/</u>	1,650 <u>k/</u>	2,340 <u>k/</u>	2,630 <u>k/</u>	8,720 <u>k/</u>	8,650 <u>l/</u>
Total industrial <u>m/</u>	2,756 <u>n/</u>	3,634 <u>n/</u>	4,204 <u>n/</u>	6,900 <u>o/</u>	6,277 <u>o/</u>	23,771	24,850 <u>p/</u>
Total national <u>m/</u>	6,506 <u>n/</u>	7,498 <u>n/</u>	8,632 <u>q/</u>	13,986 <u>q/</u>	11,100 <u>q/</u>	47,722 <u>q/</u>	42,740 <u>p/</u>

a. See Table 9, p. 37, above, and Figure 4, following p. 10, above.

b. The figure for total investment was used because it is closer in concept to the figure for capital investment used for electric power.

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Table 10

Capital Investment in the Electric Power Industry of Communist China
Compared with Investment in Selected Industries and with Total National Investment
1953-57
(Continued)

-
- c. The investment in capital construction by the Ministry of the Fuel Industry in 1954 was scheduled to be 132 percent of that in 1953. 60/ In the absence of more pertinent information, this percentage was applied to total investment in the petroleum industry.
- d. Investment in the petroleum industry in 1955 was 144 percent of that in 1954. 61/
- e. Investment in capital construction by the petroleum industry in 1956 was 142 percent of that in 1955. 62/ Total investment is assumed to be about the same.
- f. 63/
- g. Estimate.
- h. The plan figure was not given and was assumed to be the same as the figure for actual fulfillment.
- i. Figures for annual investment are based on a gradual increase to reach the 5-year total specified in the plan. Total figure is a residual.
- j. Investment in the coal industry during the first 3 years of the plan was about 11 percent of total industrial investment. 64/
- k. Total of sectors. The investment concepts of the various industries have not been reconciled and hence cannot be accurately totaled. The addition made here, therefore, is for purposes of rough comparison only.
- l. 65/. The investment concepts of the various industries have not been reconciled.
- m. The figures, although official, have not been reconciled in concept with those for separate industries and are therefore given only as an indication of magnitude.
- n. 66/
- o. 67/
- p. 68/
- q. 69/

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Table 11

Ratio of Capital Investment in the Electric Power Industry
of Communist China to Investment in the Fuel Industries,
to Total Industrial Investment, and to Total National Investment
1953-57

Category of Investment	Actual Investment						Percent
	1953	1954	1955	1956	1957	Total	Planned Total
Fuel industries	40	37	38	36	44	39	38
Total industrial	14.0	11.8	14.9	12.3	17.7	14.3	13.4
Total national	5.9	5.7	7.2	6.1	10.0	7.1	7.8

Table 12

Allocation of Capital Investment in the Electric Power Industry
of Communist China, by Government Agency a/
1953-57

Government Agency	Capital Investment	
	Amount (Million Yuan)	Percent of Total
Ministry of the Electric Power Industry	2,900	85
Local governments	150	4.5
Ministry of the Coal Industry	150	4.5
Other industrial ministries	200	6
Total	<u>3,400</u>	<u>100</u>

a. For methodology, see Appendix C. See also Table 20, p. 48, below.

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Table 13

Estimated Capital Investment in the Electric Power Industry
of Communist China a/
1953-57

Category of Investment	Rehabilitation and Reconstruction	New Construction			Percent of Total
		Completed	Not Completed	Total	
		Million Yuan			
Power plants					
Thermal					
Small <u>a/</u>	20	200	7	227	6
Medium <u>b/</u>	105	645	135	885	26
Large <u>c/</u>	169	415	443	1,027	31
Total thermal	<u>294</u>	<u>1,260</u>	<u>585</u>	<u>2,139</u>	<u>63</u>
Hydroelectric	237	262	110	609	18
Total power plants	<u>531</u>	<u>1,522</u>	<u>695</u>	<u>2,748</u>	<u>81</u>
Transmission facilities					
Transmission lines	30	250	41	321	9
Transformer and switching stations	15	125	21	161	5
Total transmission facilities	<u>45</u>	<u>375</u>	<u>62</u>	<u>482</u>	<u>14</u>
Housing	0	170	0	170	5
Grand total	<u>576</u>	<u>2,067</u>	<u>757</u>	<u>3,400</u>	<u>100</u>

a. For derivation of the values given in this table, see Methodology, Appendix C. The methodology and the information are such that no margin of error can be derived.

b. Capacity of less than 8 megawatts (mw).

c. Capacity of 8 through 49 mw.

d. Capacity of 50 mw and more.

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Table 14

Capacity Added by Reconstruction and New Construction
of Electric Power Plants in Communist China ^{a/}
1953-57

Type of Power Plant	Reconstruction		New Construction		Total	
	Amount (Megawatts)	Percent of Total	Amount (Megawatts)	Percent of Total	Amount (Megawatts)	Percent of Total
Thermal	576	26	1,076	49	1,652	75
Hydro- electric	353	16	187	9	540	25
Total	<u>929</u>	<u>42</u>	<u>1,263</u>	<u>58</u>	<u>2,192</u>	<u>100</u>

a. This table was compiled from [] the installation of
equipment. For the exact derivation of figures, see Appendix C.

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Table 15

Fixed Assets of Large Electric Power Plants in Communist China
1952-62

Period	Large Power Plants ^{a/}			Entire Electric Power Industry	Large Plants as Percent of Entire Industry
	Thermal	Hydroelectric	Total		
	Million Yuan				
End of 1952 ^{b/}	350	270	620	2,320	27
Additions 1953-57 ^{b/}	590	300	890	2,790	32
Additions 1958-62 ^{c/}	2,400	1,300	3,700	6,600	56

a. Plants with a capacity of 50 megawatts or more.

b. Based on analyses of individual power plants.

c. Gross estimate based on known planned additions to large power plants at factor costs of 1955 and on estimated costs of capacity to be added by 1962.

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Table 16

Additions to Fixed Assets in the Electric Power Industry
of Communist China a/
1953-57

Million Yuan						
Year	Assets at End of Year			Assets Added During Year		
	Ministry <u>b/</u>	Other	Total	Ministry <u>b/</u>	Other	Total
1952	1,785	535	2,320			
1953	2,075	565	2,640	290	30	320
1954	2,315	605	2,920	240	40	280
1955	2,795	715	3,510	480 <u>c/</u>	110	590
1956	3,445	825	4,270	650	110	760
1957	4,175	935	5,110	730	110	840
Total added				<u>2,390</u>	<u>400</u>	<u>2,790</u>

a. For methodology, see Appendix C. See Figure 2, following p. 6, above, and Figures 5 and 6, following p. 14, above.

b. The Ministry of the Fuel Industry in 1952-55 and the Ministry of the Electric Power Industry since that time.

c. Additions to fixed assets in 1953-55 totaled 1,010 million yuan.

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Table 17

Capital Investment in Structures and Equipment of the Electric Power Industry
of Communist China a/
1953-57

Million Yuan			
<u>Category of Investment</u>	<u>Structures</u>	<u>Equipment</u>	<u>Total <u>b/</u></u>
Power plants			
Thermal	1,140	1,000	2,140
Hydroelectric	460	150	610
Transmission facilities	330	150	480
Housing	170	0	170
Total	<u>2,100</u>	<u>1,300</u>	<u>3,400</u>

a. For methodology, see Appendix C. See Figure 2, following p. 6, above.

b. Derived from Table 13, p. 41, above, and rounded.

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Table 18

Origin of Equipment Installed by the Electric Power Industry
of Communist China a/
1953-57

Origin	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>	<u>1957</u>	<u>Total</u>	Percent of Total
	Megawatts						
Imports							
Soviet Bloc							
USSR b/	220	184	354	349	234	1,341	62
Satellites							
Czechoslovakia	0	0	30	109	92	231	10
East Germany	0	0	6	16	86	108	5
Hungary	0	0	0	8	13	21	1
Rumania	0	0	3	9	27	39	2
Total Satellites	<u>0</u>	<u>0</u>	<u>39</u>	<u>142</u>	<u>218</u>	<u>399</u>	<u>18</u>
Total Soviet Bloc	<u>220</u>	<u>184</u>	<u>393</u>	<u>491</u>	<u>452</u>	<u>1,740</u>	<u>80</u>
Switzerland	0	0	0	0	10	10	Negligible
Total imports	<u>220</u>	<u>184</u>	<u>393</u>	<u>491</u>	<u>462</u>	<u>1,750</u>	<u>80</u>
Domestic production	7	31	66	126	93	323	15
Rehabilitation of existing units c/	59	29	31	0	0	119	5
Grand total	<u>286</u>	<u>244</u>	<u>490</u>	<u>617</u>	<u>555</u>	<u>2,192</u>	<u>100</u>

a. See Figure 3,
following p. 8, above.

b. In 1952 the USSR also installed a unit with a capacity of 25 megawatts
at Fu-shun, which is not included in the totals.

c. Includes installation of units imported from the Free World by the
Nationalists but captured by the Communists before installation.

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Table 19

Cost of Equipment Installed by the Electric Power Industry
of Communist China
1953-57

Origin	Cost (Million Yuan)	Percent of Total ^{a/}
Imports		
USSR	806	62
Satellites		
Czechoslovakia	139	10
East Germany	65	5
Hungary	13	1
Rumania	26	2
Total Satellites	<u>234</u>	<u>18</u>
Total imports	<u>1,040</u>	<u>80</u>
Domestic production ^{b/}	260	20
Grand total	<u>1,300</u> ^{c/}	<u>100</u>

a. From Table 18, p. 46, above.

b. Includes rehabilitation of existing units, some of which were imported from the Free World by the Nationalists but captured by the Communists before installation.

c. From Table 17, p. 45, above.

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Table 20

Growth of Capacity of Electric Power Plants in Communist China a/
1949-57

End of Year	Ministry <u>b/</u>		Other <u>c/</u>		Total Capacity (Megawatts)	Increase During Year	
	Capacity (Megawatts)	Percent of Total	Capacity (Megawatts)	Percent of Total		Capacity (Megawatts)	Percent
1949	1,110 <u>d/</u>	60	740	40	1,850 <u>e/</u>		
1950	1,170 <u>f/</u>	64	660	36	1,830 <u>g/</u>	-20	-1
1951	N.A.	N.A.	N.A.	N.A.	1,920 <u>h/</u>	90	5
1952	1,560 <u>i/</u>	77	470 <u>i/</u>	23	2,030 <u>j/</u>	110	6
1953	1,828 <u>k/</u>	79	488	21	2,316 <u>k/</u>	286	14
1954	2,046 <u>k/</u>	80	514	20	2,560 <u>l/</u>	244	11
1955	2,460 <u>k/ m/</u>	81	590	19	3,050 <u>n/</u>	490	19
1956	3,000 <u>o/</u>	82	667	18	3,667 <u>p/</u>	617	20
1957	3,470 <u>q/</u>	82	752	18	4,222 <u>r/</u>	555	15

a. See Figures 5 and 6, following p. 14, above.

b. The Ministry of the Fuel Industry in 1949-55 and the Ministry of the Electric Power Industry since that time.

c. Derived by subtracting the figure for the Ministry from the total. The decline between 1949 and 1952 resulted from the fact that the Ministry took over more and more private plants. All of the power plants in Shanghai, for instance, were not nationalized until 1953. 70/

d. 71/

e. 72/

f. 73/

g. Estimate. The decrease in 1950 was largely a result of the Nationalist bombing of Shanghai in February 1950, in which 55 megawatts (mw) were damaged. 74/

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Table 20

Growth of Capacity of Electric Power Plants in Communist China
1949-57
(Continued)

- h. Estimate based on known installation of equipment in 1951.
- i. Estimate based on a plant-by-plant tabulation as of the end of 1952.
- j. The First Five Year Plan refers to 4,060 mw as "twice the 1952 national generating capacity." 75/ A periodical published in Peking in 1955 stated that 2,050 mw was "more than the generating capacity in 1952." 76/ [redacted] 50X1
- It is believed that this figure is average capacity rather than the capacity at the end of the year for two reasons. First, average utilization in 1952 was given as 3,700 hours and production as 7.26 billion kilowatt-hours. 78/ This is an average capacity of 1,962 mw. Second, "about 200 mw" of generating capacity were restored between 1949 and 1952. 79/ Capacity in 1949 was given as 1,850 mw 80/; capacity at the end of 1952 would therefore be close to 2,050 mw. [redacted] 50X1
- [redacted] This figure cannot be reconciled with the 200-mw increase unless average capacity is meant. An increase of 6 percent on 1,850 mw (very little, if any, change in capacity took place in 1949) would bring average capacity up to 1,961 mw in 1952. 50X1
- k. Estimate based on known and estimated additions during the year.
- l. Li Fu-chun, head of the State Planning Commission, when he presented the First Five Year Plan, reported that installed generating capacity had increased 530 mw during 1953 and 1954. 82/
- m. In September 1955, Li Fu-chun said that generating capacity would increase 900 mw during the first 3 years of the First Five Year Plan. 83/ Comparison of this figure with totals based upon increases in individual plants suggests that the figure, 900 mw, refers to the Ministry increase, inasmuch as [redacted] Ministry capacity increased 898 mw during this period. 50X1

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Table 20

Growth of Capacity of Electric Power Plants in Communist China
1949-57
(Continued)

-
- n. Liu Lan-po, Minister of the Electric Power Industry, reported in April 1956 that power-generating installations with a capacity of 1,020 mw had been built during the "past years," 84/ and Chen Chi-yuan, Chinese delegate to the Fifth World Power Conference in June 1956, stated that more than 1,000 mw of capacity were added in 1953-55. 85/
- o. The Ministry added 540 mw in 1956. 86/
- p. A Peking news release, available after this report was completed, reported that total electric power generating capacity at the end of 1956 was 3,610 mw. 87/ This figure is 2 percent less than the figure derived in this report by adding up capacities of all plants believed to be in operation at the end of 1956. According to a CIA plant analysis, capacity installed in 1956 amounted to 617 mw.
- q. Capacity was to increase 470 mw. 88/
- r. Estimate of new capacity to be added in 1957, based on analysis of individual plants.

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Table 21

Growth of Capacity of Electric Power Plants in Communist China
by Type of Plant a/
1952-57

End of Year	Thermal Power Plants <u>b/</u> (Megawatts)	Percent of Total	Hydroelectric Power Plants (Megawatts)	Percent of Total	Total Capacity <u>c/</u> (Megawatts)
1952	1,840	90.7	190	9.3 <u>d/</u>	2,030
1953	1,986	85.8	330 <u>e/</u>	14.2	2,316
1954	2,223	86.9	337 <u>e/</u>	13.1	2,560
1955	2,552	83.7	498 <u>f/</u>	16.3	3,050
1956	3,027	82.5	640 <u>g/</u>	17.5	3,667
1957	3,492	82.7	730 <u>h/</u>	17.3	4,222

a. See Figures 5 and 6, following p. 14, above.

b. Statistics for increases in hydroelectric power plants usually are more readily available than those for thermal power plants. The figure for thermal power represents a residual and therefore includes a small unknown capacity developed by plants using internal combustion engines.

c. Figures for total capacity are from Table 20, p. 48, above.

d. Plan figure. 89/

e. Based on known additions to the capacities of individual hydroelectric power plants, primarily the Ta-feng-man hydroelectric power plant in Kirin Province, where 2 units were added in 1953, 2 in 1955, and 1 in 1956, a total increase in capacity of 353 megawatts (mw).

f. About 425 mw of hydroelectric capacity were added through October 1956, of which about 117 mw were added in 1956. 90/ Therefore, about 308 mw were added in the first 3 years under the First Five Year Plan. This figure is supported by estimates of additions to individual plants.

g. "Some 450 mw" have been added under Communist control. 91/

h. 92/. The addition of a capacity of 90 mw is supported by an analysis of individual hydroelectric power plants scheduled to go into operation in 1957.

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Table 22

Increase in Plant Factor in the Electric Power Industry
of Communist China
1952-57

<u>Year</u>	<u>Production a/ (Billion Kilowatt-Hours)</u>	<u>Average Capacity b/ (Megawatts)</u>	<u>Average Annual Use c/ (Hours)</u>	<u>Plant Factor d/ (Percent)</u>
1952	7.3	1,975	3,700	42
1953	9.2	2,175	4,230	48
1954	11.0	2,435	4,510	52
1955	12.3	2,805	4,380	50
1956	15.3	3,360	4,550	52
1957	18.9	3,945	4,790	55

a. From Table 24, p. 53, below.

b. Established by averaging the capacity at the end of each year with that of the previous year. Data are from Table 20, p. 48, above, in rounded figures.

c. Production divided by average capacity and rounded.

d. The rate of use of existing facilities.

Table 23

Theoretical Plant Factor of New Capacity
Added to the Electric Power Industry of Communist China
1953-57

<u>Year</u>	<u>Cumulative Increase in Production a/ (Billion Kilowatt-Hours)</u>	<u>Cumulative Increase in Average Capacity b/ (Megawatts)</u>	<u>Average Annual Use (Hours)</u>	<u>Plant Factor (Percent)</u>
1953	1.9	145	N.A. c/	N.A. c/
1954	3.7	405	N.A. c/	N.A. c/
1955	5.0	775	6,450	74
1956	8.0	1,330	6,000	68
1957	11.6	1,915	6,060	69

a. Increase in production since 1952.

b. Increase in average capacity since the end of 1952.

c. New equipment, in order to provide all of the increase in production, would have had to run more than the 8,760 hours in a year. Hence, much of the increase came from old equipment.

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Table 24

Production and Consumption
of Electric Power in Communist China a/
1949-57

Billion Kilowatt-Hours					
Year	Production		Imports from North Korea	Total Consumption	
	Ministry <u>b/</u>	Other <u>c/</u>			
1949	N.A.	N.A.	4.3 <u>d/</u>	0.6 <u>e/</u>	4.9
1950	N.A.	N.A.	4.6 <u>f/</u>	0.2 <u>g/</u>	4.8
1951	N.A.	N.A.	5.6 <u>h/</u>	N.A.	5.6
1952	6.3 <u>i/</u>	1.0	7.3 <u>j/</u>	N.A.	7.3
1953	7.8 <u>k/</u>	1.4	9.2 <u>l/</u>	N.A.	9.2
1954	9.4 <u>m/</u>	1.6	11.0 <u>n/</u>	N.A.	11.0
1955	10.5 <u>o/</u>	1.8	12.3 <u>p/</u>	0.3 <u>q/</u>	12.6
1956	13.1 <u>r/</u>	2.2	15.3 <u>s/</u>	0.9 <u>t/</u>	16.2
1957	15.5 <u>u/</u>	3.4	18.9 <u>v/</u>	1.6 <u>w/</u>	20.5

a. See Figures 5 and 6, following p. 14, above.

b. The Ministry of the Fuel Industry in 1949-55 and the Ministry of the Electric Power Industry since that time.

c. Obtained by subtracting production supervised by the Ministry from total production.

d. 93/

e. 94/

f. Production in 1950 was 77.5 percent of previous annual peak production 95/ of 5.95 billion kilowatt-hours (kwh). 96/

g. 97/

h. Production in 1952 exceeded that in 1951 by 29.56 percent. 98/

i. Production in 1953 exceeded that in 1952 by 23.9 percent. 99/

j. 100/

k. Production in 1954 was scheduled to exceed that in 1953 by 14.63 percent, 101/ but actual production exceeded the plan by 5.4 percent. 102/

l. 103/

m. Estimated at 85 percent of total production, the amount in 1953 and 1955.

n. 104/

o. Production in 1956 was scheduled to exceed that in 1955 by 14 percent, 105/ but actual production increased by 24 percent over that in 1955. 106/

p. 107/

q. Estimate based on known installations of generating equipment operating at 50 cycles for supplying Northeast China.

r. Production in 1957 was scheduled to exceed that in 1956 by 18.13 percent. 108/

s. 109/

t. 110/

u. Planned early in 1957. 111/

v. 112/. The original plan called for production of 15.9 billion kwh. 113/

w. 114/

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Table 25

Increase in Consumption of Electric Power in Communist China
Compared with Other Countries
Selected 5-Year Periods, 1903-57

Country	Years	Increase During Period	
		Billion Kilowatt-Hours	Percent
Communist China	1953-57	13.2	180 <u>a/</u>
India	1951-55	3.4	66 <u>b/</u>
Japan	1951-55	19.1	44 <u>c/</u>
US	1903-07	8.1	135 <u>d/</u>
US	1952-56	248.9	56 <u>e/</u>
USSR	1929-33	11.4	230 <u>f/</u>
USSR	1953-57	92.1	77 <u>g/</u>

a. See Table 24, p. 53, above.

b. 115/. Period of the First Five Year Plan.

c. 116/

d. 117/. This is the most rapid 5-year increase in the history of the US.

e. 118/

f. 119/. This is the most rapid 5-year increase in the history of the USSR.

g. 120/

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Table 26

Comparison of Consumption of Electric Power
in Communist China and in the USSR
1952

Commodity	Kilowatt-Hours per Ton Produced	
	Communist China	USSR ^{a/}
Coal	26 ^{b/}	15
Pig iron	59 ^{c/}	50
Electrosteel	1,000 to 1,600 ^{d/}	800 to 1,000
Cotton textiles (combine)	3,080 ^{e/}	3,200 to 3,500
Aluminum	50,000 ^{f/}	18,000 to 22,000

a. 121/b. 122/c. 123/d. 124/e. 125/

f. 126/. This high rate is supported also by the fact that in 1944 the Fu-shun aluminum plant used 480 million kilowatt-hours (kwh) 127/ to produce 8,000 tons of aluminum, 128/ or 60,000 kwh per ton. This figure includes about 6,000 kwh for electrolytic reduction of bauxite. It is believed that the high consumption is a result of the recycling of the electrolytic process.

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Table 27

Contribution to the Gross National Product by the Electric Power Industry
of Communist China
1952-57

Year	Electric Power Industry <u>a/</u>	Total Industry <u>b/</u>	Total Gross National Product	Electric Power Industry as Percent of	
	Million Yuan <u>c/</u>			Total Industry	Total Gross National Product
1952	710	8,180	68,000	8.7	1.04
1953	890	10,270	74,000	8.7	1.20
1954	1,070	12,410	79,000	8.6	1.36
1955	1,200	13,400	84,000	8.7	1.43
1956	1,490	15,780	92,000	9.4	1.62
1957	1,810	17,610	97,000	10.3	1.86

a. The annual contribution of the electric power industry to the gross national product was derived by subtracting the estimated costs of the major inputs of materials, such as fuel, lubricants, and equipment for repair, from the estimated revenue. Costs and revenue were derived by multiplying figures for inputs and production by the estimated values of units.

b. Excluding individual handicrafts.

c. At factor prices of 1955.

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Table 28

Planned Growth of the Electric Power Industry
of Communist China
1958-62

Component	Unit	1957 <u>a/</u>	1962
Production			
Thermal	Billion kilowatt-hours (kwh)	14.8	28.8 to 31.0 <u>b/</u>
Hydroelectric	Billion kwh	4.1 <u>c/</u>	11.2 to 12.0 <u>d/</u>
Total	Billion kwh	18.9	40.0 to 43.0 <u>e/</u>
Capacity at end of year			
Thermal	Thousand megawatts (mw)	3.5	7.5 <u>f/</u>
Hydroelectric	Thousand mw	0.7	3.3 to 4.1 <u>g/</u>
Total	Thousand mw	4.2	10.8 to 11.6 <u>h/</u>
Plant factor	Percent	54 <u>i/</u>	46 <u>j/</u>

a. Data from Tables 21, 22, and 24, pp. 51, 52, and 53, respectively, above.

b. The increase during 1958-62 was scheduled to be 63 to 67 percent. The percentage increase during 1953-57 is not available.

c. Production from hydroelectric power plants will be 22 percent of total production. 129/

d. Production from hydroelectric power plants will be 28 percent of total production. 130/ The increase during 1958-62 was scheduled to be 175 to 195 percent. The percentage increase during 1953-57 is not available.

e. Proposed limits were 40 billion to 43 billion kwh. 131/ The increase during 1958-62 was scheduled to be 112 to 128 percent, compared with 156 percent during 1953-57.

f. Liu reported that the average annual increase in thermal capacity under the Second Five Year Plan will be 800 mw. 132/ The increase during 1958-62 was scheduled to be 114 percent, compared with 90 percent during 1953-57.

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Table 28

Planned Growth of the Electric Power Industry
of Communist China
1958-62
(Continued)

- g. Difference between thermal capacity and total capacity. The increase during 1958-62 was scheduled to be 350 to 470 percent compared with 285 percent during 1953-57.
- h. According to Liu Lan-po, Minister of the Electric Power Industry, the rate of increase in generating capacity under the Second Five Year Plan (1958-62) would be 35 percent higher than that for production of power. 133/ The increase during 1958-62 was scheduled to be 155 to 175 percent compared with 108 percent during 1953-57.
- i. Based on an average capacity of 3,950 mw in 1957.
- j. Based on an average capacity of 10,400 mw and production of 41.5 billion kwh in 1962, assuming that equipment with a capacity of 800 mw will go into operation during the second half of the year. The decrease during 1958-62 was scheduled to be 15 percent compared with an increase of 28 percent during 1953-57.

Table 29

Estimated Capital Investment in the Electric Power Industry
of Communist China a/
1958-62

		Million Yuan
Type of Facility	Additions to Fixed Assets	Total Capital Investment
Power plants		
Thermal	3,700	4,600
Hydroelectric	1,700	2,300
Total	<u>5,400</u>	<u>6,900</u>
Transmission facilities	900	1,000
Housing	300	300
Grand total	<u>6,600</u>	<u>8,200</u>

a. For methodology, see Appendix C. The estimates are a first approximation of an order of magnitude and hence may be subject to a range of error as high as 50 percent.

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Table 30

Approximate Regional Distribution of Industrial Activity
and of Sources of Energy in Communist China
1952

Region	Industrial Activity <u>a/</u>	Coal Reserves <u>b/</u>	Percent
			Hydroelectric Resources <u>c/</u>
Northeast	30	8	4
North	13	46	1
East	35	1	10
Central and South	11	3	20
Southwest	7	3	56
Northwest <u>d/</u>	4	39	9
Total	<u>100</u>	<u>100</u>	<u>100</u>

a. 134/. Based on the manufacturing value added.

b. 135/

c. Adapted from 136/.

d. Including the Inner Mongolian Autonomous Region.

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Table 31

Capital Investment in the Electric Power Industry
of Communist China, by Region a/
1953-57

Region	Total Investment		New Construction Only	
	Amount (Million Yuan)	Percent of Total	Amount (Million Yuan)	Percent of Total
Northeast	980	29	430	16
North	620	18	580	21
East	580	17	540	20
Central and South	560	16	530	19
Southwest	330	10	325	12
Northwest	250	7	250	9
Inner Mongolian	80	3	80	3
Total	<u>3,400</u>	<u>100</u>	<u>2,735</u>	<u>100</u>

a. For methodology, see Appendix C.

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Table 32

Additions to Fixed Assets in the Electric Power Industry
of Communist China, by Region a/
1953-57

Region	End of 1952		Additions		End of 1957	
	Amount (Million Yuan)	Percent of Total	Amount (Million Yuan)	Percent of Total	Amount (Million Yuan)	Percent of Total
Northeast	1,250	54	980	35	2,230	44
North	310	13	475	17	785	15
East	435	19	380	14	815	16
Central and South	185	8	395	14	580	11
Southwest	80	3	270	10	350	7
Northeast	30	1.5	220	8	250	5
Inner Mongolian	30	1.5	70	2	100	2
Total	2,320	100	2,790	100	5,110	100

a. For methodology, see Appendix C. The procedure and information are such that no margin of error can be determined.

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Table 33

Additions to Capacity of the Electric Power Industry of Communist China
by Region
1953-62

Region	Capacity at End of 1952	Additions		Percentage Increase	
		1953-57	1958-62 ^{a/}	1953-57	1958-62
		Megawatts			
Northeast	779	1,024	800	145	45
North	320	325	1,700	103	265
East	587	280	800	48	95
Central and South	197	253	900	129	200
Southwest	82	144	400	176	175
Northwest	34	134	300	395	180
Inner Mongolian	31	32	200	103	320
Total	<u>2,030</u>	<u>2,192</u>	<u>5,100</u>	<u>108</u>	<u>121</u>

a. Estimated on the basis of present plans.

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APPENDIX C

METHODOLOGY1. Capacity.

The methodology used in deriving total figures for national capacity to produce electric power is explained in the footnotes to the pertinent tables.* The allocation of this national capacity by region, by type of plant, by type of construction, and by administrative jurisdiction was made by adding the capacities of individual plants. The capacities of the individual plants were derived by various methods, depending upon the information available. The sum of these capacities agreed very closely with total figures derived from Chinese Communist sources.

50X1
50X12. Fixed Assets.

No statements from Communist China concerning the amount of fixed assets in the electric power industry in 1952 could be found, nor was it possible to determine the exact method of evaluating existing fixed assets at the time the Communists established their government. For this reason, three complementary methods were used to arrive at fixed assets in the electric power industry in Communist China in 1952. Each of the methods used unproved but reasonable assumptions. Because each of the methods produced an answer which closely approximated that derived by the others, the final figure is believed to be acceptable. A reasonable margin of error may be plus or minus 30 percent.

The first method entailed a rather extreme manipulation of some Chinese Communist statistics. The Central Statistical Bureau reported that 39.8 percent of the fixed assets of industry as a whole at the end of 1955 were added during 1953-55. 137/ This statement indicates that additions during 1953-55 were 66 percent of fixed investment for industry as a whole in 1952.

The article from the Central Statistical Bureau stated further that at the end of 1955 about 70 percent of the fixed assets of all industry could be considered new but that in the electric power industry only

* See Tables 20, 21, and 24, pp. 48, 51, and 53, respectively, above.

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about 60 percent of such assets could be considered new. Thus the additions to fixed assets during 1953-55 probably constituted a lower percentage in the electric power industry than in industry as a whole. These statements suggest the following ratio:

$$\frac{60 \text{ (new equipment in the electric power industry)}}{70 \text{ (new equipment in all industry)}} = \frac{X \text{ (additions to fixed assets in the electric power industry)}}{66 \text{ (additions to fixed assets in all industry)}}$$

Therefore, additions to fixed assets in the electric power industry equal 56.6 percent of the fixed assets.

On the basis of the statement by the Central Statistical Bureau that additions to fixed assets by the electric power industry during 1953-55 were 1,010 million yuan, 138/ the fixed assets of the electric power industry in 1952 are estimated to have been 1,785 million yuan.

When the Chinese Communists refer to the electric power industry, they mean only the Ministry of the Electric Power Industry. On the assumption that fixed assets in power plants that do not belong to the Ministry have the same relationship to capacity as those which do come under the jurisdiction of the Ministry, then the fixed assets of plants that do not belong to the Ministry are:

$$\frac{470 \text{ mw non-Ministry}}{1,560 \text{ mw Ministry}} = \frac{X}{1,785 \text{ million}}$$

Hence, fixed assets in non-Ministry power plants in 1952 amounted to 535 million yuan, and total fixed assets for the electric power industry (as defined in this report) were 2,320 million yuan.

A second method of arriving at the value of fixed assets in 1952 was to estimate the cost of reproducing a new plant at the end of 1952 in terms of reported unit costs of 1955 and then to allow for depreciation. On the basis of unit costs developed later for the value of completed projects in the electric power industry of Communist China in 1953-57, the cost of replacing facilities in existence at the end of 1952 would have been 4,030 million yuan. The average age of Chinese power plants, weighted by capacity, was about 10 years in 1952. Standard depreciation is calculated at 4 percent per annum according to a Chinese Communist handbook 139/ on financial management. This figure means a total depreciation of 40 percent leaving a value of 2,420 million yuan.

Finally, on the assumption that fixed assets in the electric power industry in 1952 represented the same percentage of total industrial fixed assets as was allocated to the industry under the First Five Year Plan,

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those assets may be estimated at 14 percent of 15,700 million yuan, 140/ or 2,200 million yuan. On the basis of these approximations, an estimate of 2,320 million yuan in fixed assets in 1952 seems reasonable. The figures for later years were derived by adding the annual increase in expenditures for completed basic construction.

3. Investment in Completed Basic Construction.

a. General.

No Chinese Communist statistics are available on capital investment in the electric power industry of Communist China. The figures for capital investment, therefore, have been derived from estimates of expenditures for completed power projects. The Chinese Communists use the term "completed basic construction" for this concept.

The two complementary methods which were employed to estimate the costs of completed basic construction can be used as a check upon each other. After an estimate has been derived for completed basic construction, capital investment can be determined. As yet, however, no method has been found by which the figure for capital investment can be proved.

In deriving the basic costs of construction, the figures have been determined by making estimates of expenditures for each of the components: power plants by type; housing; and transmission lines, transformer stations, and switching stations. These totals were then checked against magnitudes derived from figures for additions to fixed assets in Communist China, by industry and by type of investment, as given by the Central Statistical Bureau.

b. Computation of Total Expenditures for Completed Basic Construction from Calculations for Individual Projects.

(1) Power Plants.

The cost of basic construction of power plants was established on the cost per kilowatt of installed capacity, culled from the Chinese Communist press and multiplied by estimated capacity installed in each category of construction. New capacity was broken down by region, by new construction or reconstruction, by hydroelectric and thermal power plants, and by small, medium, and large capacities within the category of thermal power plants.*

* See Table 34, p. 66, below.

Table 34

~~Cost of~~ Construction of Hydroelectric and Thermal Power Plants
in Communist China, by Region a/
1953-57

MEGAWATTS
Million-Year

Region	Reconstruction						New Construction						Total Construction					
	Hydro- electric	Thermal					Hydro- electric	Thermal					Hydro- electric	Thermal				
		Small b/	Medium c/	Large d/	Sub- total	Total		Small b/	Medium c/	Large d/	Sub- total	Total		Small b/	Medium c/	Large d/	Sub- total	Total
Northeast	353	0	62	350	412	765	0	9	100	150	259	259	353	9	162	500	671	1,024
Less e/ Plus f/	71 0	0 0	0 0	12 0	12 0	83 0	0 0	0 0	0 11	0 55	0 66	66	71 0	0 0	0 11	12 55	12 66	83 66
Net	282	0	62	338	400	682	0	9	111	205	325	325	282	9	173	543	725	1,007
North	0	9	44	0	53	53	36	14	101	121	236	272	36	23	145	121	289	325
Less e/ Plus f/	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 31	0 138	1 169	1 169	0 0	1 0	0 31	0 138	1 169	1 169
Net	0	9	44	0	53	53	36	13	132	259	404	440	36	22	176	259	457	493
East	0	4	59	0	63	63	56	9	83	69	161	217	56	13	142	69	224	280
Less e/ Plus f/	0 0	0 0	17 0	0 0	17 0	17 0	0 37	0 4	0 36	0 77	0 117	0 154	0 37	0 4	17 36	0 77	17 117	17 154
Net	0	4	42	0	46	46	93	13	119	146	278	371	93	17	161	146	324	417
Central and South	0	7	37	0	44	44	18	31	110	50	191	209	18	38	147	50	235	253
Less e/ Plus f/	0 0	1 0	10 0	0 0	11 0	11 0	0 42	0 0	0 24	0 75	0 99	0 141	0 42	1 0	10 24	0 75	11 99	11 141
Net	0	6	27	0	33	33	60	31	134	125	290	350	60	37	161	125	323	383
Southwest	0	4	0	0	4	4	71	9	60	0	69	140	71	13	60	0	73	144
Less e/ Plus f/	0 0	1 0	0 0	0 0	1 0	1 0	0 0	0 0	0 0	0 50	0 50	0 50	0 0	1 0	0 0	0 50	1 50	1 50
Net	0	3	0	0	3	3	71	9	60	50	119	190	71	12	60	50	122	193

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Table 34

~~Cost of~~ Construction of Hydroelectric and Thermal Power Plants
in Communist China, by Region a/
1953-57
(Continued)

MEGAWATTS
~~Million kilowatts~~

Region	Reconstruction						New Construction						Total Construction					
	Thermal						Thermal						Thermal					
	Hydro- electric	Small <u>b/</u>	Medium <u>c/</u>	Large <u>d/</u>	Sub- total	Total	Hydro- electric	Small <u>b/</u>	Medium <u>c/</u>	Large <u>d/</u>	Sub- total	Total	Hydro- electric	Small <u>b/</u>	Medium <u>c/</u>	Large <u>d/</u>	Sub- total	Total
Northwest	0	0	0	0	0	0	6	26	77	25	128	134	6	26	77	25	128	134
Less <u>e/</u>	0	0	0	0	0	0	0	3	10	0	13	13	0	3	10	0	13	13
Plus <u>f/</u>	0	0	0	0	0	0	0	0	12	38	50	50	0	0	12	38	50	50
Net	0	0	0	0	0	0	6	23	79	63	165	171	6	23	79	63	165	171
Inner Mongolian	0	0	0	0	0	0	0	17	15	0	32	32	0	17	15	0	32	32
Less <u>e/</u>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plus <u>f/</u>	0	0	0	0	0	0	0	0	0	10	10	10	0	0	0	10	10	10
Net	0	0	0	0	0	0	0	17	15	10	42	42	0	17	15	10	42	42
Total basic construction	353	24	202	350	576	929	187	115	546	415	1,076	1,263	540	139	748	765	1,652	2,192
Less <u>b/</u>	71	2	27	12	41	112	0	4	10	0	14	14	71	6	37	12	55	126
Plus <u>c/</u>	0	0	0	0	0	0	79	4	114	443	561	640	79	4	114	443	561	640
Net	282	22	175	338	535	817	266	115	650	858	1,623	1,889	548	137	825	1,196	2,158	2,706

a. For methodology, see p. 65, above.

b. Capacity of less than 8 megawatts (mw).

c. Capacity of 8 through 49 mw.

d. Capacity of 50 mw and more.

e. For reconstructed plants and for new plants with a capacity of less than 8 mw, the amount deducted is one-half the ~~amount~~ of the capacity added in 1953. For new plants with a capacity of more than 8 mw, the amount deducted is one-half the ~~cost~~ of the capacity added in 1953 and 1954.f. For plants with a capacity of less than 8 mw, the amount added is one-half the ~~cost~~ of new capacity to be added in 1958. For plants with a capacity of more than 8 mw, the amount added is one-half the ~~cost~~ of new capacity to be added in 1958 and 10 percent of the ~~cost~~ of new capacity to be added in 1959.

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These capacities were then tabulated. The basis for the tabulation was an examination of every known power plant with a capacity estimated to be more than 500 kilowatts.

Additions of capacity by plant, by year, by region, by type of plant, and by administrative jurisdiction were added and were found to agree with known information in these categories. The consistency and accuracy of statistics from Communist China were generally of a very high order and comparable to similar statistics from the US, the USSR, and Western Europe. The value of capital construction completed during 1953-57 was 2,790 million yuan.*

Reconstruction of the Ta-feng-man hydroelectric power plant, because of the rebuilding that had to be done on the dam as well as on the equipment, was evaluated at 60 percent of the cost of a new hydroelectric power plant. Reconstruction of thermal power plants was estimated to be one-half the cost of construction of a new power plant of similar capacity.

The estimated average costs of construction of new capacity are 1,400 yuan per kilowatt for hydroelectric power plants, 1,800 yuan per kilowatt for small thermal power plants, 1,200 yuan per kilowatt for medium thermal power plants, and 1,000 yuan per kilowatt for large thermal power plants. ¹⁴¹/ These estimates are based on a rather lengthy and detailed article on costs of constructing power plants. The figures agree generally with other fragmentary reports on the same subject.

No allowances were made, as technically there should have been, for changes in costs from year to year and from region to region. There were no useful figures for this refinement, and their use would have complicated even more an already overly involved computation. The degree of inaccuracy incurred by this omission cannot be judged exactly, but the figures for total national additions to fixed assets agree with figures from the Central Statistical Bureau of Communist China, and therefore the difference probably is not great.

(2) Housing.

The figure for housing is derived from a single reference which states that the Ministry of the Electric Power Industry spent 40 million yuan for housing in 1956. Total square meters of housing constructed by the Ministry in the previous three years under the First Five Year Plan suggested an investment of about 80 million yuan for those years. It is assumed that 50 million yuan was spent by the Ministry for housing in 1957.

* See Table 35, p. 69, below.

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Table 35

Value of Completed Capital Construction
in the Electric Power Industry of Communist China
1953-57

Type of Project	Capacity (Megawatts)	Unit Cost (Yuan per Kilowatt)	Value (Million Yuan)
Power plants			
Reconstruction			
Hydroelectric	353	840	297
Thermal			
Small a/	24	900	22
Medium b/	202	600	121
Large c/	350	500	175
Total thermal	<u>576</u>		<u>318</u>
Total reconstruction	<u>929</u>		<u>615</u>
New construction			
Hydroelectric	187	1,400	262
Thermal			
Small a/	115	1,800	207
Medium b/	546	1,200	655
Large c/	415	1,000	415
Total thermal	<u>1,076</u>		<u>1,277</u>
Total new construction	<u>1,263</u>		<u>1,539</u>
Total power plants	<u>2,192</u>		<u>2,154</u>
Housing			170
Transmission facilities			
Reconstructed lines			61 d/
New lines			250 e/
Transformer and switching stations			155 f/
Total transmission facilities			<u>466</u>
Grand total			<u>2,790</u>

- a. Capacity of less than 8 megawatts (mw).
b. Capacity of 8 through 49 mw.
c. Capacity of 50 mw and more.
d. Reconstruction of 1,393 kilometers (km) at 45,000 yuan per km.
e. Construction of 2,787 km at 90,000 yuan per km.
f. Estimated to be one-half the value of transmission lines.

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It is believed to be impractical to separate the housing for workers at power plants at industrial combines from housing for other workers at the combine. Also, it is assumed that workers in local power plants, which are all small and are located in developed towns, would live in existing housing. Housing expenditures by the Ministry are assumed to be total housing expenditures.

(3) Transmission Facilities.

No Chinese Communist statistics are available on costs of constructing transmission lines and transformer and switching stations. Figures from the USSR are available, however, and a ratio of 1 ruble to 1 yuan seems to hold fairly well in the construction of thermal power plants; therefore, Soviet costs in rubles per kilometer (km) of transmission line ^{142/} were converted to yuan for purposes of an estimate. Since the exact distribution of the length of transmission lines by voltage could not be determined, an average figure of 90,000 yuan per km of line was used. It was further assumed that about one-third of the total length of 4,180 km of transmission lines added under the First Five Year Plan was in reconstructed lines. The cost of reconstructed lines is one-half that of the cost of a new line. Investment in transformer and switching stations was estimated at one-half the above amount on the basis of analogy with the USSR.

c. Computation of Total Expenditures for Completed Basic Construction from Figures of the Central Statistical Bureau.

As a check against the expenditures on completed basic construction derived in the manner just discussed, the same figures were derived from those compiled by the Central Statistical Bureau. By assuming that total additions to fixed assets equaled expenditures on completed basic construction,* the figure could be derived from an article in the periodical of the Central Statistical Bureau. ^{143/} Additions to fixed assets during 1953-55 in the electric power industry (by the Ministry of the Electric Power Industry according to the Chinese Communist definition) were 1,010 million yuan. The capital construction tasks of the First Five Year Plan were 43.1 percent fulfilled by the end of 1955. ^{144/} By assuming that the same percentage applied to completed capital construction (that is, additions to fixed assets), the original plan for the Ministry of the Electric Power Industry for 1953-57 was 2,340 million yuan for completed basic construction. By applying the percentage increases for 1956 and 1957 as they appeared in the Chinese Communist press to the figure for the plan thus derived, a total

* This is true by definition if there are no retirements. Evidence seems to indicate that there were no appreciable retirements in 1953-57.

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of 2,390 million yuan was obtained for actual expenditures on completed construction by the Ministry. To this figure for the Ministry, there was then added the 400 million yuan for non-Ministry plants arrived at by using the unit-cost method. The total figure of 2,790 million yuan arrived at in this fashion was, fortuitously, the same as the one derived by the unit-cost method and hence constituted a check on the other method.

4. Computation of Capital Investment During the Plan Period.

Capital investment in 1953-57 is the total expenditure on capital construction projects during these years. It is derived by starting with the expenditure for completed basic construction, subtracting from it the investment made before 1953 in projects going into operation in 1953, and adding the investment made before 1958 in projects to go into operation in 1958 and later.*

Figures for capital investment in transmission lines, transformer and switching stations, and housing were derived from estimates of total capital investment by subtracting one-half of the estimated expenditures for completions in 1953 and adding one-half of the estimated expenditures for completions in 1958. It was assumed that housing would be completed in the year in which it was started.

Capital investment in the Ministry of the Electric Power Industry is greater in relation to the value of completed basic construction than in non-Ministry categories mainly because the longer term projects, necessitating much investment before 1958 in plants to be completed after 1958, are almost exclusively undertaken by the Ministry.

5. Allocation of Investment to Equipment and Structures.**

For the reconstructed Ta-feng-man hydroelectric power plant, it was estimated that one-third of the expenditures would be for equipment and installation (as the plant was restored for 60 percent of the total cost of a new plant, and equipment plus installation is 20 percent of the total cost of a new plant).

It was estimated that, for thermal power plants, five-sixths of the cost of reconstructed plants, one-half of the cost of new plants in operation, and one-sixth of the cost of new plants not yet in operation were for equipment and installation.

* See Table 34, p. 66, above, and Table 36, p. 72, below.

** See Table 37, p. 73, below.

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Table 36

Value of Capital Investments
in the Electric Power Industry of Communist China
1953-57

Type of Project	Capacity (Megawatts)	Unit Cost ^{a/} (Yuan per Kilowatt)	Value (Million Yuan)
Power plants			
Reconstruction			
Hydroelectric	282	840	237
Thermal			
Small ^{b/}	22	900	20
Medium ^{c/}	175	600	105
Large ^{d/}	338	500	169
Total thermal	<u>535</u>		<u>294</u>
Total reconstruction	<u>817</u>		<u>531</u>
New construction			
Hydroelectric	266	1,400	372
Thermal			
Small ^{b/}	115	1,800	207
Medium ^{c/}	650	1,200	780
Large ^{d/}	858	1,000	858
Total thermal	<u>1,623</u>		<u>1,845</u>
Total new construction	<u>1,889</u>		<u>2,217</u>
Total power plants	<u>2,706</u>		<u>2,748</u>
Housing			170
Transmission facilities			482
Grand total			<u>3,400</u>

a. From Table 35, p. 69, above.

b. Capacity of less than 8 megawatts (mw).

c. Capacity of 8 through 49 mw.

d. Capacity of 50 mw and more.

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Table 37

Allocation of Expenditures on Power Plants
in Communist China a/
1953-57

<u>Purpose of Expenditure</u>	<u>Percent</u>	
	<u>Hydroelectric</u>	<u>Thermal</u>
Equipment	15	40
Installation	5	10
Structures		
Dams and associated works	70	0
Power house	10	0
Materials	<u>b/</u>	20
Transport	<u>b/</u>	11
Labor	<u>b/</u>	16
Profits and taxes	<u>b/</u>	3
Subtotal	<u>80</u>	<u>50</u>
Total	<u>100</u>	<u>100</u>

- a. [redacted] an item in the Chinese Communist press which stated that two-thirds of the investment in hydroelectric power plants is for dams and earthworks and two-thirds of the investment in thermal power plants is for equipment and materials. 146/
- b. Included under dams and associated works and power house.

50X1
50X1

It was estimated also that practically all the cost of transmission lines was for construction and that two-thirds of the cost of transformer and switching stations was for equipment and installation.

6. Investment Under the Second Five Year Plan.

There are no available figures on investment in the electric power industry of Communist China under the Second Five Year Plan. The figures presented in Table 31* are a first approximation based on reasonable factors. The totals were derived in much the same fashion as those for

* See Table 31, p. 60, above.

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the First Five Year Plan. Additions to fixed assets were derived on a unit-cost basis (yuan per kilowatt). The Chinese have reported the cost of some of the major new hydroelectric power plants to be constructed under the plan. An estimate was added to these figures for medium and small hydroelectric power plants. The unit cost of all sizes of thermal power plants and of the medium and small hydroelectric power plants was reduced by 15 percent from the unit-cost figures used for estimating the First Five Year Plan. This computation takes into account the planned reduction in unit costs of the new plants. The figure of 15 percent was used because it represented the average reduction in unit cost of the construction of power plants in the USSR during 1950-55. Figures for housing and transmission lines were derived by simply doubling those for the First Five Year Plan.

Total capital investment under the Second Five Year Plan is equal to 125 percent of the additions to fixed assets. Under the First Five Year Plan, total capital investment was equal to 123 percent of the additions to fixed assets. Total capital investment is a larger percentage of additions to fixed assets under the Second Five Year Plan than under the First because a proportionately larger number of hydroelectric power plants are scheduled to be constructed. The percentage of total investment which must be made before a plant becomes operative is greater for hydroelectric power plants than for thermal power plants. Allocation of total investment by type of plant used the same proportions of additions to fixed assets to capital investment in each category as were estimated for the First Five Year Plan.

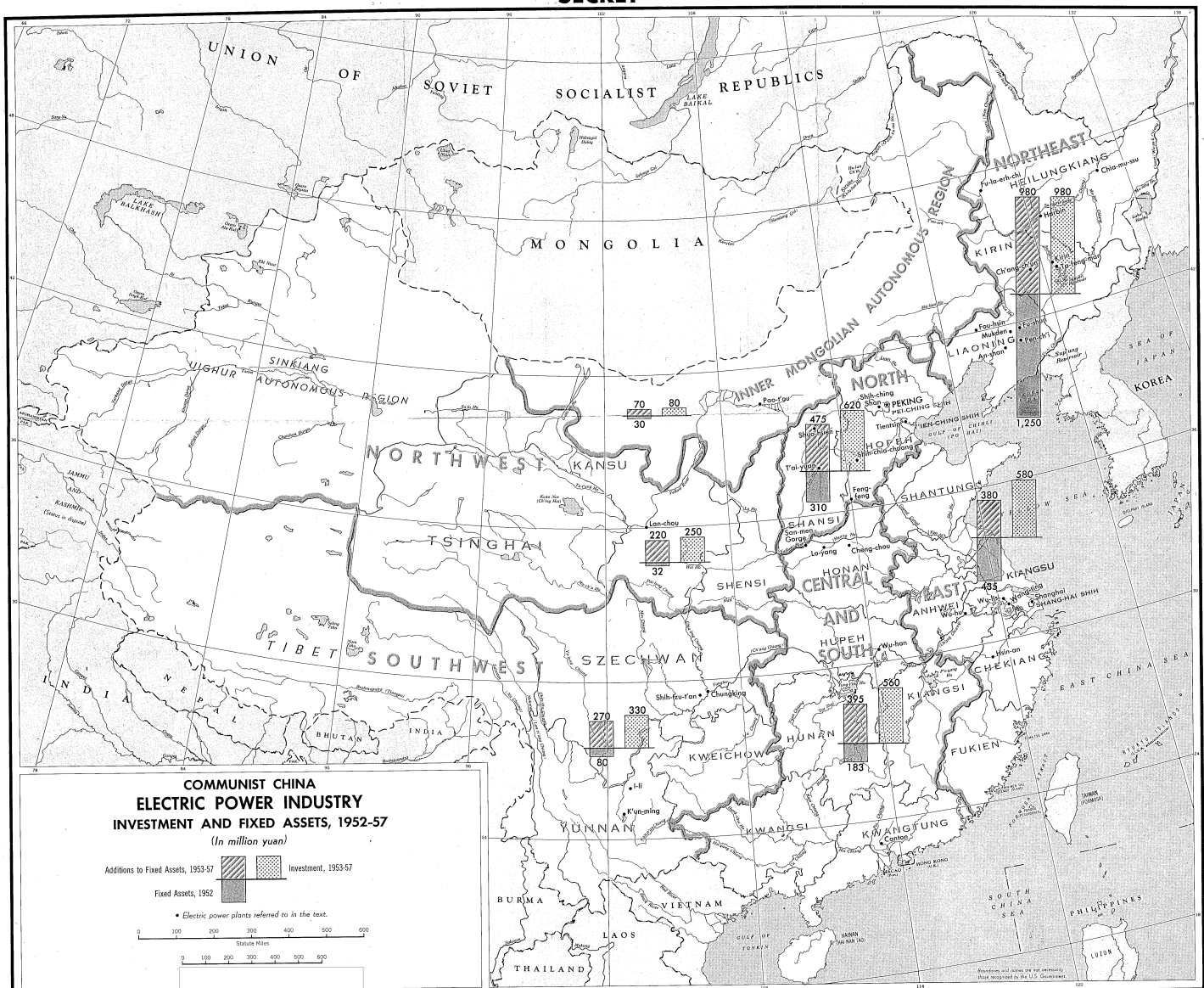
All the large hydroelectric power projects are under the control of the Ministry of the Electric Power Industry. Investment by the Ministry was derived by increasing the proportion of investment by the Ministry from 85 percent in the First Five Year Plan to 88 percent in the Second Five Year Plan.

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